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Volume 2

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EDITOR

Helen B. Correll

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EDITOR
HELEN B. CORRELL

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WRIGHTIA

VOLUME 2 SEPTEMBER 1959 NUMBER 1

A NEW GENUS OF ACANTHACEAE FROM MEXICO

EMERY C. LEONARD

Among the plants collected in Mexico in the year 1943 by Dr. C. L. Lundell and his wife, Amelia A. Lundell, were a number of rare and interesting specimens of Acanthaceae. One of these, discovered on a cliff near Chilpancingo, Guerrero, represents a new genus. Its closest affinity is with the large and widely distributed American genus *Aphelandra*, as indicated by the unilocular stamens, but these branching shrubs with their corky fissured stems and oval silvery leaf blades and the compact solitary terminal glandular spikes of small yellow flowers with their deeply included, almost sessile stamens, are utterly unlike *Aphelandra*.

LUNDELLIA Leonard, gen. nov.

Frutex, caulibus ramosis, suberosis, rimosis, subquadrangularibus; lamina foliorum argentea, pilis dendroideis, glandulosis vel acutis, cystolithis nullis; spicae terminales compactae, glanduloso-hirtellae; bracteae parvae, imbricatae; calycis segmenta 5; corolla parva, labiis duobus, labio superiore 2-lobato, erecto, brevi, labio inferiore trilobato, lobo medio orbiculato, lobis lateralibus ovalibus; stamina 4, inclusa, antheris uniloculatis; stigma bilobatum; ovarium glabrum.

Lundellia is an extreme development from *Aphelandra*. The corky rimose twigs, the silvery minutely punctate leaves, the presence of dendroid hairs, and the short terminal glandular spikes of yellow flowers, with minute included stamens are characters by which the genus may be recognized. It is named for Dr. C. L. Lundell, the collector of the type.

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Lundellia argyrea Leonard, sp. nov. Fig. 1.

Frutex, caulibus glabris vel apice retrorse hirtellis; lamina foliorum ovata vel ovalis vel suborbiculata, firma, integra, scabra, glabra vel parce hirtella, utrinque argentea; gemmae et folia immatura tomentosa, pilis dendroideis; spicae terminales; bracteae oblongae, acutae, dense hirtellae, pilis glandulosis et eglandulosis intermixtis; bracteolae lanceolatae cetera bracteis similes; calycis segmenta anguste lanceolata cetera bracteis similia; corolla

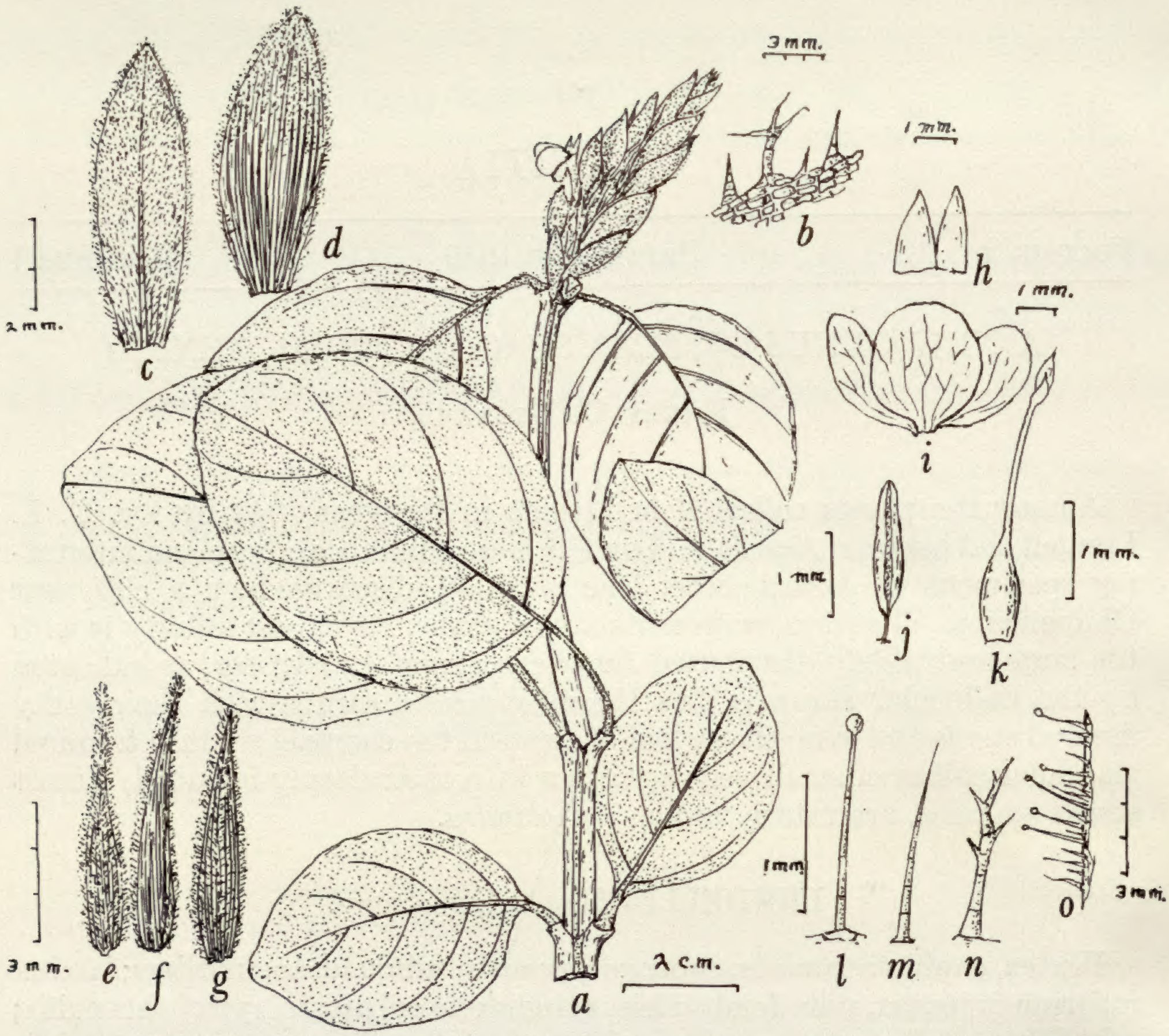

Fig. 1. *Lundellia argyrea* Leonard (*Lundell 12603*): a, Tip of stem showing spike; b, hairs from margin of leaf blade; c, bract (outer surface); d, same (inner surface); e, bractlet (outer surface); f, same, (inner surface); g, one of the calyx segments; h, upper lip of corolla; i, lower lip of corolla; j, stamen; k, pistil; l, glandular hair; m, acute hair; n, dendroid hair; o, margin of bract enlarged to show glandular and acute hairs.

parva, bilabiata, labio superiore profunde bilobato; stamina inclusa; ovarium glabrum.

Branched shrubs up to 3 feet (c. 1 meter) high; stems corky, furrowed, or rimose, glabrous or the tips minutely and retrorsely hirtellous; leaf blades ovate, oval or suborbicular, up to 4.5 cm. long and 4 cm. wide, obtuse or rounded at tip and base and briefly decurrent, firm, entire, scabrous, sparingly hirtellous or glabrous, the hairs, up to 0.25 mm. long occurring mostly on the margins, rigid, whitish, simple or branched, especially the ones at the tip, both leaf surfaces silvery gray, the lower surface minutely punctate, and pitted, nitid, deeply and minutely reticulate, the upper surface indistinctly bullate and minutely muricate, appearing under low magnification to be minutely reticulate, the costa and lateral veins (3 or 4 pairs) of the lower surface prominent, of the upper, obscure; buds and early ex-

panding leaves densely white-tomentose with dendroid hairs c. 0.25 mm. long; cystoliths none; petioles 5 to 8 mm. long, minutely and rather densely hirtellous, the hairs about 0.08 mm. long, spreading or toward base of petiole retrorse, sometimes intermixed with a few longer (up to 0.25 mm. long) dendroid hairs; flowers borne in dense terminal spikes 2 to 2.5 cm. long and 8 mm. broad; bracts oblong, 6 to 6.5 mm. long, 2.5 to 3 mm. wide, acute at apex the outer surface and the upper half of the inner surface densely hirtellous, the hairs spreading, straight or slightly curved, mostly up to 0.16 mm. long (or a few marginal hairs as much as 0.5 mm. long) glandular and eglandular hairs intermixed, the inner surface of the lower half glabrous and conspicuously striate-nerved; bractlets lanceolate, 6.5 mm. long, slightly exceeding 1 mm. in width near base, the pubescence of the outer surface and tip of inner similar to that of the bracts, the inner surface strongly striate-nerved; calyx segments 5, similar to the bractlets; rhachis shallowly furrowed, more or less puberulous; corolla yellow with maroon base (Lundell), 6 mm. long from base of tube to mouth, the tube 2.25 mm. broad at base, 1.5 mm. at middle and 2 mm. at mouth, the broadened basal portion glabrous, the upper part rather densely retrorsely pubescent with straight or slightly curved rigid hairs up to 0.1 mm. long, the lips glabrous within and sparingly pubescent without, the hairs spreading, up to 0.16 mm. long, the upper lip suberect, 2 mm. long, 1.5 mm. wide, 2-lobed, the lobes ovate, 2 mm. long, 1.25 mm. wide, acute, the lower lip more or less spreading, 4.5 mm. long, 3-lobed, the middle lobe suborbicular, 4.25 mm. in diameter, broadly obtuse, the lateral lobes oval, 3.5 mm. long, 2.5 mm. wide, obtuse, the 3 lobes conspicuously veined; stamens included, the filaments slender, 0.5 mm. long; anthers oblong, 1.5 mm. long, 0.6 mm. broad, rounded at both ends; ovary 1.5 mm. long, 0.75 mm. wide, glabrous; style slender, about 1 mm. long; stigmas lanceolate, acute, the longer lobe about 0.3 mm. long, the other 0.25 mm. long, both 0.16 mm. broad; capsules not seen.

Type in the U. S. National Herbarium, No. 2263363, collected on a cliff along stream near Chilpancingo, Guerrero, Mexico, October 21, 1943, by C. L. Lundell (No. 12603). Isotypes MICH, LL.

The specific epithet is from the Greek ἀργύρεος, meaning "like silver" in allusion to the leaf blades.

United States National Museum
Smithsonian Institution
Washington, D. C.

STUDIES OF PHYSOSTEGIA—I

NEW SPECIES AND OBSERVATIONS ON OTHERS

CYRUS LONGWORTH LUNDELL

A study of the genus *Physostegia* has been undertaken to clarify taxonomic and distributional problems, with particular reference to the species occurring in Texas. Seasonal observations in the field together with the collection of representative material of the various species make possible a reinterpretation of various entities.

All the Texas representatives of the genus are perennial, either rhizomatous or stoloniferous. During the flowering season, particularly near its end, one or more underground buds appear at the base of each stem. From these the rhizomes rapidly grow and develop a root system, becoming established and giving rise in due time to the next year's plant. All the species investigated have been found to propagate vegetatively by this means.

The subterranean stem systems are of diagnostic importance, ranging from very short ascending rhizomes in such species as *P. pulchella* Lundell, *P. Digitalis* Small, *P. micrantha* Lundell, and *P. praemorsa* Shinners to elongated rhizomes and stolons in *P. Correllii* (Lundell) Shinners, and *P. intermedia* (Nutt.) Engelm. & A. Gray. The aquatic and marsh species have very slender ones, nearly white, while the plants which occupy less moist better drained habitats have thicker rhizomes. These fleshy underground stems often persist two or three years, as careful digging and washing out of the soil will readily reveal. The rhizomes easily break off from the base of the old stem, but the presence of a basal scar on each reveals its perennial nature when this has occurred.

In 1941 I became interested in the Texas species of *Physostegia* for they are among the most attractive wild flowers of a state noted for the great diversity of beautiful native plants. All with the exception of *P. micrantha* Lundell are as worthy of cultivation as the common garden plant, *P. virginiana* (L.) Benth. Noteworthy in this respect is *P. pulchella*, which occurs so abundantly in North Central Texas. Its fine large campanulate flowers which range from pink-lavender to deep reddish-purple are very showy. The plant persists in alluvial bottom land soils, and should do well in gardens.

Physostegia pulchella Lundell, sp. nov. Figs. 2 and 3.

Perennis, caule glabro ad 140 cm. alto; foliis inferioribus petiolatis laminis chartaceis oblongo-lanceolatis vel oblongo-ellipticis vel oblanceolato-oblongis, 7–10 cm. longis, raro ad 15 cm. longis, 1–1.3 cm. latis, raro ad

2.5 cm. latis, apice acutis vel obtusis, serratis, foliis supernis valde reductis; inflorescentiae cum bracteis calycibusque dense pubescente; calycibus campanulatis, 6–7 mm. longis, dentibus ovato-deltoideis acutis; corollis 2–3 cm. longis; filamentis villosis; antheris glabris vel parce villosis.

Erect rhizomatous herb, up to 140 cm. high, slender or robust, sometimes the squarrose basal part of stem up to 1.5 cm. in diam., the internodes progressively longer from base to apex, the nodes pubescent in a line between the petioles, the stems otherwise glabrous below the inflorescence. Basal leaves chartaceous, usually slender petiolate, the petioles up to 8 cm. long, expanded and clasping at base, narrowed above, the blades entire, subentire, or remotely dentate. Leaves above basal oblong-lanceolate or oblong-elliptic, up to 12 cm. long, 2.5 cm. wide, tapering into winged petiole, obtuse at apex, the margin subentire to denticulate. Leaves of middle stem rather firm, chartaceous, pallid, oblong, oblanceolate-oblong, or oblong-elliptic, usually 7.5 to 10 cm. long, sometimes up to 15 cm. long, usually 1 to 1.3 cm. wide, often up to 2 cm. wide, sessile and clasping at base or with a broadly winged petiole below, apex acute or obtuse, the margin usually serrate to base, sometimes subentire below. Apical leaves reduced, becoming bract-like below the inflorescence. Inflorescence erect, densely pubescent throughout, simple or with two or more lateral branches from the basal bracts, usually less than 30 cm. long, sometimes up to 60 cm. long, the flowers rather remote, not crowded, subsessile, subtended by small ovate, acuminate bracts 2–3 mm. long, the bracts less than half the length of calyx at anthesis; pedicels in fruit not over 1.5 mm. long. Calyx tubular-campanulate, 6 to 7 mm. long at anthesis, the teeth pellucid-punctate, ovate-deltoid or ovate, 1.5 to 2 mm. long, acute. Corolla pink-lavender to deep reddish-purple, the lobes purplish, the throat red-purple striped or maculate, finely pubescent, 2 to 3 cm. long, the tube subequaling calyx, the upper lobe entire, the lower lobes inconspicuously emarginate, subentire. Filaments villous below. Anthers glabrous or sparsely short villous. Fruiting calyx turbinate, 6 to 7 mm. long, about 5 mm. in diam. at base, the teeth rigid, slightly incurved. Seed brown, 3-angled, smooth, about 3 mm. long, the ridges hyaline.

TEXAS: Kaufman County, north side of U. S. highway 175, about 1 mile east of Crandall, in wet bottom land along stream bed, May 12, 1959, *C. L. Lundell 16026* (type, LL); same locality, June 4, 1958, *Lundell 15101* (LL); same locality, April 18, 1959, *Lundell 16025* (LL).

P. pulchella is abundant in the more humid eastern half of the Blackland Prairies of Texas, particularly in Hunt, Kaufman, and Navarro counties. Various collections representing this species have been referred to *P. angustifolia* Fernald, which was described from Mississippi. In its pink-lavender to deep reddish-purple corollas, coarser pubescence, smaller floral bracts usually less than half the length of the calyx at anthesis, small ovate-deltoid acute calyx teeth, and much larger entirely different leaves, *P. pulchella* is amply distinct from *P. angustifolia*.

The small corollas of some plants of *P. pulchella*, sometimes less than 2

Fig. 2. *Physostegia pulchella* Lundell, ×½, type specimen, *C. L. Lundell 16026* (LL). Illustrated by Phoebejane Horning.

Fig. 3. *Physostegia pulchella* Lundell, ×½, showing perennial nature of underground stems. One or more basal buds give rise to the next season's growth. Illustrated by Phoebejane Horning.

cm. long, have led to confusion of the species with *P. intermedia* (Nutt.) Engelm. & A. Gray, which is not related.

In *P. angustifolia* the corollas usually are larger and white, rarely tinged lavender; also, the species is pruinose, and the narrow oblong-linear or linear leaves are attentuate and entire at the apex.

Physostegia micrantha Lundell, sp. nov. Fig. 4.

Perennis, caule glabro ad 90 cm. alto; foliis inferioribus petiolatis laminis lineari-lanceolatis vel oblongo-lanceolatis, ad 12 cm. longis, 1.1 cm. latis acuminatis vel acutis, repandis vel sinuatis, denticulatis, foliis supernis valde reductis; spicis solitariis vel paniculatis elongatis ad 20 cm. longis, rhachi puberulo; calycibus campanulatis 3–4 mm. longis puberulis; corollis albescentibus, 5–7 mm. longis; filamentis glabris.

Erect rhizomatous herb, up to 90 cm. high, slender, the internodes progressively longer from base to apex, the upper nodes puberulent, otherwise glabrous below the inflorescence. Leaves small, glabrous, chartaceous, linear-lanceolate or oblong-lanceolate, up to 12 cm. long, 1.1 cm. wide; the basal petiolate; the medial largest, sessile, clasping at base; the apical reduced, bract-like below the inflorescence; margin repand to sinuate, rather remotely and inconspicuously denticulate; apex acuminate or acute. Inflorescence up to 20 cm. long, slender, usually simple, sometimes with two lateral branches at the basal node; densely puberulent; bracts shorter than the calyx, puberulent. Flowers subsessile, the pedicels about 1 mm. long, puberulent. Calyx pellucid-punctate, puberulent, 3–4 mm. long, the teeth acute, slightly shorter than tube. Corolla white, tinged lavender or pink, puberulent, 5–7 mm. long, the tube campanulate, shorter than the calyx. Filaments glabrous.

TEXAS: Titus County, off highway 49, about 1 mile southeast of Mount Pleasant, in open wet bottom land of Hart Creek, May 29, 1958, *C. L. Lundell 15075* (type, LL); same locality, May 24, 1958, *D. S. Correll & C. L. Lundell 18878* (LL).

P. micrantha is known only from a single large colony from which the above collections were made. It grows in wet heavy clay alluvium in a seasonally flooded area.

The flowers of the species, only 5–7 mm. long, are the smallest in the genus and very distinctive. In habit and leaf characteristics, *P. micrantha* closely resembles *P. intermedia* (Nutt.) Engelm. & A. Gray, which occurs in scattered colonies in the same locality.

Stamens of *P. micrantha* are abortive. Possibly this is a relict species, having lost the ability to reproduce sexually, and now dependent on the production of rhizomes for survival.

PHYSOSTEGIA CORRELLII (Lundell) Shinners, Rhodora 51: 120–122. 1949.

Dracocephalum Correllii Lundell, Wrightia 1: 165. 1947.

TEXAS: Val Verde County, along stream near the International Bridge at Del Rio, June 26, 1946, *D. S. Correll & H. B. Correll 12890* (type, LL), flowers lavender,

Fig. 4. *Physostegia micrantha* Lundell, type specimen, *C. L. Lundell 15075* (LL), ×½; calyx and corolla, ×2. Illustrated by Phoebejane Horning.

spotted with purple; along ditch on route #277, 1 mile north of the International Bridge to Villa Acuna (Mexico), type locality, July 18, 1957, *D. S. Correll & I. M. Johnston 18204* (LL), plant fleshy, flowers pink-purple; along irrigation canal 2 miles south of Del Rio, July 8, 1958, *D. S. Correll & I. M. Johnston 19427* (LL), flowers lavender-pink, purplish streaked, plant coarse, up to 7.5 ft. tall, stem about 1 inch thick at base, as many as 20 nodes per stem, leaves somewhat leathery and firm. NEW MEXICO: 1851–52, *C. Wright 1536* (US, PH).

The only adequate collections of this remarkable plant are from the type locality at Del Rio, Texas, and I am indebted to Dr. D. S. Correll for securing these and for his field notes on the plant. *P. Correllii* appears to be a Mexican species, for the following collections, although fragmentary, are to be referred here.

MEXICO: NUEVO LEON: Monterrey, Santa Catarina, alt. 600 m., July, 1911, *Bro. G. Arsene 6224* (*Bro. Abbon 82*) (US).

I have not seen the specimens, *Wright 1530* (GH) from Santa Cruz, Sonora; and, *Palmer 2043* (GH) from Saltillo, Coahuila, but they have been identified as this species.

P. Correllii, a very robust species, has large thick creeping rhizomes superficially resembling those of the Johnson grass, *Sorghum halepense* (L.) Pers.

PHYSOSTEGIA DIGITALIS Small, Bull. Torrey Club 25: 613. 1898.

TEXAS: Angelina County, in open pinelands near Bouton Lake, Angelina National Forest, July 12, 1958, *D. S. Correll & I. M. Johnston 19651* (LL), flowers white to pink-lavender. Bowie County, New Boston, along railroad east of town, June 27, 1945, *C. L. Lundell 13995* (LL, US), plants erect, corolla lavender, maculate within; 19 miles west of Texarkana, sandy soil along railroad track, July 2, 1948, *Eula Whitehouse 20143* (US), perennial, corolla lavender; along railroad near Queen City, at entrance of Farm Road 2327 to U. S. highway 59, July 24, 1958, *C. L. Lundell & Amelia A. Lundell 15118* (LL), perennial, with short thick rhizomes, corolla pale lavender, maculate within; about 1.5 miles east of New Boston, abundant along railroad, July 25, 1958, *Lundell & Lundell 15119* (LL), perennial, with short thick scaly rhizomes, plants up to 6 ft. high, leaves up to 3 inches wide, corolla pale lavender. Cherokee County, 4 miles south Alto, piny woods, sand, July 19, 1940, *Ellen Hamby 1425* (NA). Hardin County, 74 miles northwest of Silsbee, then 1.3 miles south, infrequent in open pine woods, July 9, 1949, *V. L. Cory 56661* (NA), stems erect, up to 8.5 dm. high. Jasper County, 6 miles north of Brookeland, frequent on roadside, July 7, 1949, *Cory 56554* (NA), stems erect, up to 9 dm. high or more; in longleaf pine savannah, 18 miles northwest of Jasper, July 12, 1958, *Correll & Johnston 19631* (LL), stems solitary, up to 6 ft. tall, from a short rhizome, flowers pink-lavender. Jefferson County, between Cheek and Fannett, along railroad through coastal prairie, June 20, 1947, *Lundell & Lundell 14733* (LL, US), perennial, leaves coriaceous, corolla lavender, maculate within with reddish-purple spots; along railroad between Cheek and Fannett, July 23, 1958, *Lundell & Lundell 15117* (LL), perennial with short thick rhizomes. Newton County, July 23, 1939, *B. C. Tharp 42-136* (GH). Smith County, Swan, in swamps, July 7, 1902, *J. Reverchon 3252*

(US). Walker County, 2.5 miles north of Elmina, frequent on railway right of way, June 30, 1948, *Cory 54580* (LL), stem simple, erect, 11–12 dm. high. County undetermined, 1843, *F. Lindheimer 147* (GH, US); *Drummond* (GH). LOUISIANA: Vernon Parish, 2 miles west of Leander, grassy field with wet areas from springs, July 7, 1950, *G. L. Webster & R. L. Wilbur 3233* (US), frequent in wet places, corolla lavender with purple spots on limb within.

I have examined the Louisiana specimens in the New York Botanical Garden cited by Small (l.c.) in the original description: "The one was gathered on prairies by Mr. Carpenter while the other is from Alexandria, collected by Dr. Hale." Although this type material is fragmentary like most old collections of *Physostegia*, there can be no doubt as to the reference of the collections cited from eastern Texas and Louisiana to this species. The plant is found usually in undisturbed areas of the East Texas Timberlands and Coast Prairie, which indicates that the persistence of the species is due largely to its perennial habit. The short thick rhizomes often persist for two or three years.

P. Digitalis, although robust, is a very attractive plant, which makes a showy display in June. It is abundant along the undisturbed railroad right of way between Texarkana and New Boston in Bowie County. The species is inadequately represented in herbaria, which may account for its misinterpretation in recent publications.

PHYSOSTEGIA PRAEMORSA Shinners, Field Lab. 19: 166–167. 1951.

Physostegia serotina Shinners, Field Lab. 24: 17–19, 1956.

TEXAS: Brazoria County, Alvin, alt. 50 ft., Oct. 23, 1935, *Geo. L. Fisher 3534* (US). Culberson County, frequent along stream, limestone soil below Pratt Lodge, McKittrick Canyon, Guadalupe Mountains, alt. 5000 ft., Aug. 30, 1950, *Barton H. Warnock 9426* (LL), flowers lavender with converging purple lines. Fannin County, off U. S. highway 82, 10 miles east of Bonham, 0.6 mile west of Windom, chalk outcrop along railroad, May 29, 1958, *C. L. Lundell 15067* (LL), sterile; same locality, July 25, 1958, *C. L. Lundell & Amelia A. Lundell 15122* (LL), sterile; same locality, Oct. 14, 1958, *C. L. Lundell 15246* (LL), perennial herb; rhizomes short, ascending; rosette leaves slender petiolate; corolla pale lavender. Harris County, Oct. 9, 1903, *F. W. Thurow 9* (US); Houston, Nov. 2, 1913, *Fisher 504* (US); Houston, Sept. 15, 1917, *Fisher 5164* (US); Houston, Oct. 9, 1918, *Fisher 195* (US); Houston, Oct. 5, 1921, *Fisher 10* (US); Houston, alt. 50 ft., Nov. 1, 1937, *Fisher 37247* (US); Webster, alt 50 ft., Nov. 3, 1937, *Fisher 37248*; Houston, coastal prairie, off U. S. highway 75 (north), Oct. 30, 1958, *C. L. Lundell 15247* (LL), perennial with short ascending rhizomes arising at end of season from base of underground stem; bracts and calyx purplish; corolla deep lavender. Jefferson County, Amelia, Oct. 5, 1934, *V. L. Cory 11108* (GH); 9 miles west of Beaumont, frequent in low grassland along the railway, Oct. 4, 1945, *Cory 50021* (GH, US). County undetermined, Guadalupe Creek, Nov. 1, 1881, *V. Havard s.n.* (US). LOUISIANA: Rapides Parish, Alexandria, Sept., 1838, *Jos. Hale s.n.* (US). NEW MEXICO: County undetermined, Guadalupe Mountains, Cottonwood Canyon, alt. 7000 ft., Oct. 3, 1916, *W. R. Chapline 734* (US); Guadalupe Mountains, Gray's Ranch, Aug. 29, 1937, *L. N. Goodding s.n.* (US).

In the original description of *P. praemorsa* (l.c.), the type locality is given as "0.6 mile west-southwest of Honey Grove (10 miles east of Bonham), Fannin Co., Texas." I found the species off U. S. highway 82, 10 miles east of Bonham, but this locality is 0.6 mile west of Windom, not Honey Grove. Here there are scattered plants on a chalk outcrop and along the bank of the railroad.

To study the life cycle of an autumnal species, plants of *P. praemorsa* in the type locality were kept under observation throughout the year. The sterile ones collected in May and July were fully developed. In October the species was in full flower, and mature fruits were present. At this time basal vegetative growth of three seasons was found. The population appears to be perpetuated largely by the production of rhizomes which have been termed "basal offsets".

Probably because of better seasonal conditions, the plants were considerably larger than reported in the original description, comparing favorably in size with those of the coastal prairie and Guadalupe Mountains. It is noteworthy that the flowers of depauperate plants from the barren chalk outcrop are as large as those from robust plants growing in more favorable nearby sites.

A study of the available material reveals no differences of significance to distinguish *P. serotina* Shinners. In some collections the leaves are more linear and the calyx teeth are more deltoid than ovate, but in the nature of its rhizomes, pubescence, bracts, flowers, and general habit, *P. praemorsa* is remarkably uniform throughout its wide range.

The occurrence of the species in the Guadalupe Mountains of Texas and New Mexico was unexpected, and it should be found on the Edwards Plateau.

SOME NOTEWORTHY AMERICAN BORAGES[1]

IVAN M. JOHNSTON

Heliotropium Torreyi Johnston, nom. nov.

Heliotropium angustifolium Torrey, Bot. Mex. Bound. 137. 1858.
not *H. angustifolium* Raf., Herb. Raf. 79. 1833.

Unhappily an all but forgotten binomial published by Rafinesque, as a substitute for *H. curassavicum* L., antedates *H. angustifolium* Torr. As a substitute for the later homonym I am proposing the name, *H. Torreyi*.

When he published *H. angustifolium*, Torrey had before him collections from Cibolo, Presidio Co., Texas (*Bigelow*); near the Rio Grande in the Big Bend (*Parry*); near Brackettville (collector not given); upper Devils River (*Wright 480*); Sycamore Creek, betw. Del Rio and Brackettville (*Wright 1546*); and Monterrey, Mexico (*Edwards & Eaton*). Most of these are scanty, poor specimens. The best one and that which Torrey naturally would have relied upon in drawing up his description is *Wright 1546* which, according to the collector, came from "stony prairies, Zoquete Creek, May 18, 1851". This specimen at New York I am accepting as type. "Zoquete Creek" is that serving as boundary between Val Verde and Kinney counties, Texas and now known as "Sycamore Creek". The type was accordingly collected within a mile or so of the bridge over Sycamore Creek on Highway No. 90, between Brackettville and Del Rio, Texas.

Heliotropium (Coeloma) **Ruiz-Lealii** Johnston, sp. nov.

Herba perennis ut videtur rhizomatosa glaberrima; caulibus erectis teretibus e basi stricte ramosis, foliosis, 1–3 dm. altis 1–3.5 mm. crassis; foliis alternis carnosis glaucis crispis medium versus vel infra medium latioribus, lanceolatis vel elliptico-lanceolatis, 6–12 mm. latis 15–30 mm. longis, non rariter obscure pinnato-nervatis, apice acutis, basi acutis sessilibus; inflorescentia terminali ebracteata; cymis densifloris saepe geminatis maturitate ad 5 cm. longis saepe 1–2 cm. longe pedunculatis; floribus biseriatis congestis; calyce carnoso sessili vel subsessili, lobis plus minusve aequalibus 2–2.5 mm. longis lanceolatis vel oblongo-lanceolatis acutis tubo corollae brevioribus, duobus non rariter plus minusve connatis ceteris fere ad basin divisis; corolla glabra ca. 5 mm. longa, limbo albo infundibuliformi 4–5 mm. diametro, lobis 2.5 mm. longis 1.5 mm. latis conduplicatis apice rotundis margine aliquantum crispis, sinibus loborum acutis haud plicatis, tubo 2.5–3 mm. longo flavo basi ca. 1.5 mm. crasso apicem versus plus

[1] STUDIES IN THE BORAGINACEAE NO. XXX.

minusve constricto; filamentis brevissimis 1 mm. supra basin corollae affixis, antheris lanceolatis 2–2.4 mm. longis basin versus affixis e basi cordulata sursum gradatim attenuatis, apice acuminatis e faucibus corollae fere exertis; granulis pollinis globosis sublaevis 22–27 μ diametro poris 3 instructis; ovario glabro; stigmate sessili 0.7 mm. alto a basi ca. 1 mm. diametro sursum apicem 0.3–0.4 mm. diametro truncatum obscure 4-lobulatum versus gradatim contracto; fructu bilobato glabro valde lateraliter compresso evidenter costato et obscure tuberculato et ruguloso saepe ca. 3 mm. alto paulo supra basin 2 mm. crasso, latere secus suturam excavato; nuculis duobus parellelis erectis angulatis uterque intus 2-locularibus et 2-seminatis dorse nullo modo sulco mediali donatis.

ARGENTINA: entre El Balde y Tucunuco, prov. San Juan, hojas anchas encrispadas, glaucas, carnosas!, Dec. 7, 1957, *Ruiz Leal & F. Roig no. 18,837* (type, LL).

In most of its structures the present plant is very suggestive of *Heliotropium curassavicum* L. and its varieties. It agrees with these in its glabrous, glaucescent somewhat succulent herbage, inflorescence, calyx, corolla, stamens, and stigma, but differs in having its fruit somewhat compressed laterally and two-lobed, and its two nutlets each two-seeded. The fruit of *H. curassavicum* is radially symmetric (not compressed laterally) and breaks up into four single seeded nutlets. The 2-seeded nutlets of *H. Ruiz-Lealii* are not grooved medially down the back nor do they present any other evidence of either an incipient or a suppressed commissure there. They never divide into single-seeded nutlets. The leaves of the new species tend to be broadest below their middle. They are sharply acute and tend to be distinctly lanceolate and not at all spatulate as are those of *H. curassavicum*. Though also fleshy, they are obviously less so than in *H. curassavicum* and are thinner and broader than is customary in that species and their margins are distinctly crisped. Crisped leaves are found in *H. Johnstonii* Rag., of Argentina, but that plant is a very close relative of *H. curassavicum* and like the latter has oblanceolate or spatulate leaves rather than lanceolate ones. Its fruit breaks up into 4 nutlets and accordingly is also very different from that of *H. Ruiz-Lealii*.

The new species evidently belongs in *Heliotropium*, section Coeloma. It has the 2-seeded nutlets, and furthermore, also the stout sessile conic stigma and the free, very elongate lanceolate anthers characteristic of that section. A similar stigma and anthers of the same distinctive type occur also in *H. curassavicum* in the section Halmyrophila. The agreement is so close, that after a reappraisal of the two sections, I am now of the opinion that the sections Coeloma and Halmyrophila must be directly and closely related. As now constituted, these two sections differ only in the fruit. *Heliotropium Ruiz-Lealii* is of especial interest since it combines distinctive characters of the two and has obvious relatives in both.

It is with great pleasure that I have associated with this interesting plant the name of Dr. Adrian Ruiz Leal, of the Facultad de Ciencias Agrarias of

Mendoza. Dr. Ruiz Leal is well known for his long, continued and very discriminating collecting in middle-western Argentina. The present *Heliotropium* is simply one of the more recent of his many discoveries of rare plants in that region.

Heliotropium curassavicum L. var. **fruticulosum** Johnston, var. nov.

Planta fruticulosa erecta modice carnosa; caulibus rigidulis in sicco haud fistulosis, 1–2.5 mm. crassis; foliis angustis carnosulis crassiuculis 10–40 mm. longis 1–3.5 mm. latis medium versus vel supra medium latioribus haud venosis margine nullo modo crispis rectis obscure encrassatis vel aliquantulum revolutis; corolla 3–5 mm. longa non rariter lobis parvis 0.8–1 mm. longis donata; granulis pollinis laevibus 22–27 μ diametro poris 3 donatis; fructu 2–2.5 mm. alto paulo supra basin 1.8–2 mm. crasso apice truncato ca. 1 mm. crasso; nuculis maturis dorse haud suberosis fere laevis obscurissime tuberculatis et costatis; stigmate late conico ca. 0.7 mm. alto; basi ca. 1 mm. diametro apice minute obscurissime bilobulato.

ARGENTINA: Capilla, dept. Lavalle (Lagunas del Rosario), Mendoza, abundante en suelos aridos, plantas erectas de color verde glauco, comun, Jan. 8, 1952, *Ruiz Leal 14536* (LL); Capilla, Mendoza, plantas erectas de color verde tierno hasta obscuro, poco carnosas, Jan 8, 1952, *Ruiz Leal 14537* (LL); entre L. Balde y Tucunuco, prov. San Juan, en zona de médanos, comun, Dec. 7, 1957, *Ruiz Leal & F. Roig 18840* (type, LL); Angaco Norte en margenes del Rio Juan, prov. San Juan, comun, Oct 29, 1954, *Ruiz Leal 16347* (LL); entre Tamberias y Calingasta, prov. San Juan, Sept. 21, 1954, *Ruiz Leal 16314* (LL).

In Argentina *H. curassavicum* L. is represented in northern Patagonia by the var. *typicum*, and, farther north, by the var. *argentinum* Johnston. The var. *fruticulosum* is another variant worthy of recognition. It appears to be confined to the province of San Juan and adjacent portions of Mendoza. This variety differs from both var. *typicum* and var. *argentinum* in its erect fruticulose stems, very narrow leaves, and slightly larger nearly smooth fruit. The plant has slender erect rigid somewhat lignified stems. They are not flexible, juicy, herbaceous and decumbent or procubent as in the other varieties. The fruit of the var. *fruticulosum* does not develop a corky mesocarp. The back of its nutlets is only very obscurely ribbed or tuberculate and not prominently so as in other forms of *H. curassavicum*.

Lasiarrhenum Lundellii Johnston, sp. nov.

Herba multicaulis perennis; caulibus erectis simplicibus ad 5 dm. altis hispidulo-villosis (pilis gracilibus 2–3 mm. longis) basin versus 3–3.5 mm. crassis; foliis e basi caulis sursum gradatim majoribus, infimis squamatis, superioribus lanceolatis 4–5 cm. longis et medium versus 12–15 mm. latis; lamina folii majoris apice acuta, basi acuta vel obtusiuscula sessili, supra viridi strigosa nerviis impressis notata, subtus secus nervos hispidulo-villosa alibi strigosa prominenter 5-nervata; nervis tribus interioribus api-

cem laminae attingentibus quam duobus exterioribus longioribus et paulo validioribus; inflorescentia terminali ut videtur simplici et pauciflora, juventate modice circinata; bracteis foliaceis flores haud vel vix superantibus; calyce 5-fido ad 4 mm. longe pedicellato, lobis inaequalibus linearibus sub anthesi 0.8–1 cm. longis 1–1.5 mm. latis; corolla alba obovoidea ca. 1.5 cm. longa a basi ca. 2 mm. diametro sursum gradatim ampliata ca. 10 mm. supra basin crassissima (0.8–0.9 mm.) deinde orem 5–6 mm. latum versus constricta, sine faucibus distincta, extus strigosa, intus infra basis loborum glandulis et pilis sparsis inconspicuisque obsita alibi glabra; annulo ca. 0.5 mm. supra basin corollae gesto 5-lobato; lobis corollae triangularibus ca. 2 mm. latis et 1.4 mm. altis erectis obtusiusculis; filamentis ca. 6.5 mm. supra basin tubi corollae affixis dorsi-ventraliter compressis glaberrimis plus minusve lanceolatis ca. 6.5 mm. longis, 1.7–2 mm. latis medium versus vel paulo infra medium latioribus, basi late affixis deorsum 1–2 mm. longe decurrentibus; antheris infra medium affixis lanceolatis, dorse pilis 1–2 mm. longis antrorse adpressis pallidis vestitis, partibus fertilibus ad 6 mm. longis et 1–1.5 mm. latis, apice sterili 1–1.3 mm. longo basi 0.6–0.8 mm. lato attenuato acuto terminatis; stylo elongato gracillimo sub anthesi 3–5 mm. longe exerto; stigmate late obconico ca. 0.3 mm. diametro 0.2 mm. longo apice truncato; fructu ignoto.

MEXICO: Oaxaca, above Tejocote, on mountain side in pineland, July 25, 1943, *C. L. Lundell 12296* (type, LL).

A well marked second species of *Lasiarrhenum*. From the well known *L. strigosum* (HBK.) Johnston, widely ranging in southern Mexico, the present species differs in its lower growth, shorter and proportionately broader leaves, fewer-flowered inflorescences, and obovoid corollas. In *L. strigosum* the corolla has a cylindric tube which above abruptly expands into a distinctly campanulate throat. The corollas of present species do not have a sharply defined tube and throat. From the base the corolla swells gradually for two-thirds of its total length and then contracts more abruptly towards its mouth. In lateral profile the corolla is distinctly obovate in form. The anthers of the two species seem indistinguishable. There is, however, a difference in the filaments. In the proposed species they are broadest at or below the middle, whereas in *L. strigosum* they are broadest at or above the middle. In *L. strigosum* the style is bilobed and bears two separate stigmas. In *L. Lundellii* the style is simple and bears a broadly obconic stigma which is simple or only slightly and obscurely lobed.

MYOSOTIS LATIFOLIA Poir., Encyc. Suppl. 4: 45. 1816.

Myosotis silvatica, subsp. *latifolia* (Poir) Vestergr., Ark. f. Bot. 29A, no. 8, p. 14, 1938.
Myosotis azorica sensu Johnston, Contr. Gray Herb. 70: 42. 1924 & l.c. 78: 28. 1927.
Myosotis sylvatica sensu Californian botanists.

WASHINGTON: Snohomish Co., Big Four Inn, Cascade Mts., 1940 *Thompson 14535*. CALIFORNIA: Humboldt Co., Carlotta, *Tracy 7385*; Sonoma Co., near

Occidental, 1954, *Sommer 81*; Marin Co., Mill Valley 1913, *Suksdorf 520*; Alameda Co., Oakland, Mills College, 1903, *Husted*; San Mateo Co., near Pescadero, 1929, *Wolf 3735*; Monterey Co., Carmel, 1950, *Raven 2596*. COLOMBIA: dept. Norte de Santander, Mutiscua, 1927, *Killip & Smith 15583*; dept. Santander, east of Las Vegas, 1926, *Killip & Smith 15583*; Bogota, 1876, *Bayon*; Pasa, Rio Ambato, 1932, *Heinrichs 46*. BOLIVIA: Canyon of La Paz River, 1920, *Shepard 174*. CHILE: Copiapo, 1886, *Gigoux*; Santiago, 1886, *Gigoux*; Corral, 1934, *Gunckel 4878*; Valdivia, 1930, *Gunckel 1784*. BRASIL: Guarmaranga, Ceara, *Bolland*. URUGUAY: dept. Colonia, 1926, *Herter 81748*; dept. Montevideo, Migualeto, 1931, *Herter 5621*.

This species is the *Myosotis* most commonly cultivated in Latin America and along the Pacific Coast of the United States. In both areas it escapes from the garden and has demonstrated its ability to persist and spread as a feral plant. The characters of this distinctive robust large-flowered species were recognized by me long ago, l.c., but described under the incorrect name, "*Myosotis azorica*." More recent authors, particularly those in California, have usually identified it with *Myosotis sylvatica*, a species of northern Europe. Our plant, however, is without doubt that described as *Myosotis latifolia* Poir. and is a native of northwestern Africa (Algeria) and the Canary Islands. The earliest records of the species in America are from southern South America. These cultivated plants may have sprung from seeds collected by some traveller in the Canary Islands, during a stop-over while travelling to Chile or Argentina.

Vestergren, in his posthumous account of *Myosotis*, classes *M. latifolia* Poir. as a subspecies of *M. sylvatica*. This treatment, while suggestive of the general relationship of the plant, is entirely too conservative. I have had no difficulty in separating this Canary Island and Algerian plant from its European relatives even while working in the extensive representations of the genus at Kew, London and Paris. It has a characteristic aspect, a natural range, and has more claim for recognition than most of the so-called species generally recognized in Europe within this large and bewildering genus.

Cryptantha gypsites Johnston, sp. nov.

Herba multicaulis fortasse perennis 10–15 cm. alta; caulibus pluribus decumbentibus dichotome ramosis graciliter villoso-hispidulis (pilis laxe antrorseque adpressis 0.3–1.0 mm. longis); foliis spathulato-oblanceolatis 10–40 mm. longis infra apicem 1–4 mm. latis, subtus hispidulis (pilis gracillimis basi discoidea erumpentibus erectis vel adpressis 0.3–1.0 mm. longis), supra sparse hispidulis vel subglabris, margine sparse ciliolatis; inflorescentia terminali saepe furcata; cymis maturitate unilateralibus racemiformibus saepe 4–6 cm. longis abundanter bracteatis; bracteis lanceolatis sessilibus eis inferioribus quam floribus proximatis fere duplo longioribus; calyce ad anthesin 2–2.5 mm. longo subsessili; calyce fructifero ovato 2.5–3.5 mm. longo tardissime deciduo hispidulo pilis ad 1 mm. longis ascendentibus vestito, lobis anguste lanceolatis conniventibus; corolla alba 3–4 mm. longa; limbo 4–5 mm. diametro; lobis rotundis 1.6–2.0 mm. longis 1.4–1.7

mm. latis; tubo ad 1.5 mm. longo a basi 0.7–0.8 mm. diametro sursum gradatim ampliato apice 1.2–1.4 mm. diametro; faucibus subapertis appendiculas invaginatas flavas puberulentas trapeziformes 0.2 mm. altas gerentibus; annulo evidente 5-lobato; antheris ellipticis 0.5–0.6 mm. longis supra medium tubi corollae gestis; nuculis honomorphis 0.8–1.2 mm. longis 0.7–0.9 mm. latis 0.3–0.4 mm. crassis, dorse ovatis convexis evidenter pallideque verrucosis marginem angulatum paulo incrassatum pallidum circumdatis, ventre obtusis; nuculo abaxillari subpersistenti; sulco nuculae de apice deorsum gradatim dialato vel solum infra medium aperto nullo modo excavato; gynobasi anguste pyramidali ca. 1 mm. alta nuculis breviore basi 0.4–0.5 mm. crassa; stylo ad anthesin basis antherarum attingente, maturitate nuculas 0.5–0.7 mm. longe superante.

MEXICO: Nuevo Leon, on gypsum in open pine woods, 8 mi. south of Galeana, July 20, 1958, *D. S. Correll & I. M. Johnston 19872* (type, LL); open pine slope 4 mi. south of Pablillo, July 20, 1958, *Correll & Johnston 19901* (LL); gypsum flat in valley 3 mi. east of Highway No. 57 on road to Galeana, July 21, 1958, *Correll & Johnston 19966* (LL).

A very well marked species known only from the highlands of southern Nuevo Leon where it is apparently confined to gypsum or gypseous soils. In the field it was mistaken for a form of *C. albida* (HBK.) Johnston, the species with which it is probably most closely related. From *C. albida*, however, it is readily distinguished by its low spreading habit, loose dichotomous branching, larger corollas, long protruding style that much surpass the nutlets, and dorsiventrally compressed nutlets with thickened pale angulate margins and non-excavate attachment-scar. Like *C. albida*, the present species appears to be a summer-flowering and not a spring-flowering plant. The specimens available have remnants of evidently crowded basal leaves. Some of the lowermost stems appear to be persisting portions of the stems of the season previous. The root also seems to be more than that of a seasonal annual and possibly may be that of a short-lived perennial.

CRYPTANTHA CRASSISEPALA (Torr.) Greene, Pittonia 1: 112. 1887.

Eritrichium crassisepalum Torrey, Pacif. R. R. Survey Reports, ed. 1, 2^2: 321. 1855, without description.

Eritrichium crassisepalum Torrey & Gray, Pacif. R. R. Survey Reports, ed. 2, 2^4: 171. 1857, description.

The name of this species was first published in 1855 in Torrey's report of the collections of Capt. Pope's expedition contained in the octavo first edition of the Pacific Railroad Survey Reports. Two lines of print were devoted to the species as follows: "*ERITRICHIUM CRASSISEPALUM*, *n. sp.* With the preceding. A common species in Western Texas and New Mexico, but not hitherto described." The species preceding *E. crassisepalum* in the catalogue is *Lithospermum breviflorum*. Its source, and hence that of *E. crassisepalum* also, is given: "Gravelly soil, on the Pecos; April "

In the second, much more elaborate, quarto edition of Capt. Pope's Report, the botanical catalogue is authored by Torrey & Gray. Our species is provided with a description for the first time. Data concerning its geographic distribution and reference to collections made on the expedition are given as follows: "On the Pecos, Llano Estacado, etc.; in sandy soil; March. A common species in Western Texas and New Mexico. It was found by Frémont on the Upper Platte. It is the same as No. 640 of Fendler's New Mexican collection."

The type of *Eritrichium crassisepalum*, the collection made on Pope's expedition, is preserved at the New York Botanical Garden. The label with the type gives its source as: "Pecos River, Western Texas, Capt. Pope." Accordingly, not only the two original publications of the species, but also the type collection associate the plant with the Pecos River and Capt. Pope's expedition. With considerable justification, therefore, the Pecos River Valley has become generally accepted as the type locality for the species.

Unfortunately, *Eritrichium crassisepalum* as originally described by Torrey & Gray, was a mixture of two closely related species. These two, *Cryptantha crassisepala* and *C. minima* were first distinguished by Johnston (Contr. Gray Herb. 74: 58–59. 1925), who selected the bractless southern and western plant as true *C. crassisepala* and assigned the more northern bracteate plant of the Great Plains to *C. minima* Rydb. The type specimen of *C. crassisepala* at New York consists of two plants of the bractless, *C. crassisepala* and two of the bracteate *C. minima.* The Frémont collections mentioned when the species was originally described represents *C. minima.* The New Mexican collection (no. 640) of Fendler like the type of *C. crassisepala* seems to be an equal mixture of true *C. crassisepala* and *C. minima.*

A study of Capt. Pope's itinerary reveals that his expedition with Dr. W. L. Diffenderfer, who actually was the botanical collector, travelled easterly along Delaware Creek to its confluence with the Pecos River where a camp was established on March 8, 1854. Ten days later Pope and most of his party crossed the Pecos and began travelling southeasterly down the north side of the river through what is now Loving and Ward counties, Texas. On March 24th, when about 15 miles west of Grand Falls, the party turned away from the river and headed northeasterly for Big Spring, Howard County, where it arrived March 31st. In his report Pope refers to that area traversed between the Pecos River and Big Spring as part of the Llano Estacado. During the following month the party first went northwesterly from Big Spring to Sulphur Springs, Martin Co, and then turned northeasterly heading directly towards Fort Belknap in Young County. Accordingly, during March the party spent over two weeks in the Pecos Valley and less than a week on the southern portion of the Llano Estacado. During all of April the party was east of the Llano Estacado and crossing the red plains of north-central Texas.

The published data and that on the label with the type specimen, associate *Eritrichium crassisepalum* with the Pecos River which, as we can de-

termine from Pope's itinerary, must mean the 75 miles of the Pecos Valley in Loving and Ward counties, Texas. The collection must have been made in March. This data seems trustworthy, at least so far as it concerns the bractless plants in the mixed type of the species. These represent a recognizable geographic form of true *C. crassisepala* with large corollas, which I have seen only from this section of the Pecos Valley and areas directly adjacent, in Ward, Winkler, Crane and Upton counties. The source of the other material in the mixed type of *E. crassisepalum* is not readily determined. This bracteate plant, referable to *C. minima* Rydb., is primarily a northern species which merely reaches its southern limit in the Pecos Valley and is rare and erratic in occurrence so far south. In the general region traversed by Pope it has been collected near Pyote, Ward Co., near Girvin, Pecos Co. and near Big Spring, Howard Co. Possibly the Expedition may have met the species while travelling between the Pecos and Big Spring. Were this the case the mention of Llano Estacado when *E. crassisepalum* was described would be understandable.

The two geographic varieties of *Cryptantha crassisepala* may be distinguished as follows:

Cryptantha crassisepala (Torr.) Greene var. **typica** Johnston, var. nov.

Planta grandiflora; corolla 4.5 mm. longa quam calyce evidenter longiore; limbo 3–5 mm. diametro; lobis 1.5 mm. diametro; tubo 1.7–2 mm. longo; antheris 0.5 mm. longis ca. 1.2 mm. supra basin corollae affixis.

TEXAS: Crane Co., 6–14 mi. west of Crane, May 4, 1957, *Warnock & Mullins 14429 & 14433* (LL). Ward Co., 7 mi. west-southwest of Monahans, May 5, 1947, *McVaugh 8176* (LL, TEX); 3 mi. nw. of Monahans, sandy, May 4, 1946, *Cory 51964* (US); east of Pyote, April 17, 1941, *Lundell 10257* (LL); north of Pyote, April 30, 1942, *Lundell 11390* (LL). Winkler Co., east of Kermit, dunes, April 30, 1942, *Lundell 11397* (LL); 10 mi. east of Kermit, dunes, May 13, 1957 *Correll 16355* (LL). Upton Co., 3 mi. west of McCamey, April 16, 1941, *Lundell 10228* (LL, US). Indefinite: Pecos River, Western Texas, *Capt. Pope* in pt., mixed with *C. minima* (type, NY).

This typical form of the species is known only from sandy places in the Pecos Valley and just north of it, in Ward, Crane, Upton and Winkler counties, Texas.

Cryptantha crassisepala (Torr.) Greene var. **elachantha** Johnston, var. nov.

Planta parviflora; corolla 3 mm. longa calyce vix longiore inconspicua; limbo 2.5 mm. diametro; lobis 0.6–0.8 mm. diametro; tubo 1.5 mm. longo; antheris 0.4 mm. longis 1 mm. supra basin corollae affixis.

TEXAS: Jeff Davis Co., Apr. 20, 1932, *Whitehouse 8357* (TEX); 3 mi. northwest of Chispa, March 18, 1941, *Warnock & Rose-Innes 481* (TEX). Brewster Co., Alpine, Sul Ross College campus, Aug. 12, 1936 *Warnock T. 178* in pt., mixed with *C. mexicana* (TEX); 0–2 Ranch [about 40 mi.] south of Alpine, March 26, 1929,

A. B. Clawson 29–113 in pt., mixed with *C. mexicana* (LL); hills about mouth of Santa Elena Canyon, Big Bend, March 16, 1947, *Warnock 47040* (LL). Culberson Co., just south of Van Horn, Apr. 5, 1936, *Sperry T. 65* (US); Van Horn Mts., April 15, 1949, *Tharp & Havard 49309* (TEX); betw. Van Horn and Sierra Blanca, May 8, 1938, *Warnock T. 350* (US). Hudspeth Co., Quitman Range, Apr. 23, 1938, *H. E. Wheeler* (LL); igneous north end of Quitman Mts., 8 mi. west of Sierra Blanca, April 21, 1947, *McVaugh 8040* (type LL, TEX). El Paso Co., Fabens, Apr. 10, 1930, *M. E. Jones 25815* (POM); El Paso, 1881, *G. R. Vasey* (NY); El Paso, 1858, *Dieffenderfer 79* (PH); El Paso, March 20, 1932, *Whitehouse 8354* (TEX); McKelligon Canyon, El Paso, March 26, 1948, *Warnock 7661* (LL, TEX); Mt. Franklin, El Paso, April 19, 1952, *Warnock 10386* (LL); slopes of Mt. Franklin, 2 mi. west of El Paso, April 10, 1952 *Warnock 10310* (LL).

Only Texas collections of the variety are cited. From Trans-Pecos Texas the var. *elachantha* extends westward through New Mexico into Arizona and thence southward into northern Mexico and northward into southern Utah and southwestern Colorado. It is the most common and most widely ranging form of *C. crassisepala*.

CRYPTANTHA MINIMA Rydb., Bull. Torr. Bot. Cl. 28: 31. 1901; Johnston, Contr. Gray Herb. 74: 58. 1925.

Eritrichium hispidum Buckley, Proc. Acad. Philad. 1861: 462. 1861, not *Cryptantha hispida* (Phil.) Reiche, 1908.

In the past Buckley's *Eritrichium hispidum* has been identified with *Cryptantha texana* (DC.) Greene or more commonly with *C. albida* (HBK.) Johnston. The type of *E. hispidum* was recently reexamined at Philadelphia. Without doubt, it represents the bracteate generally northern relative of *C. crassisepala* to which the name *C. minima* Rydb. is properly applicable!

The type collection of *E. hispidum* is given by S. B. Buckley as collected "on the Upper Colorado of Texas" in June, of either 1860 or 1861. According to Buckley (First Annual Report of Geol. & Agric. Survey of Texas, pp. 8 and 10. 1874), during June 1860 he was working in Navarro County, Texas where the present species is most certainly neither known nor to be expected! The following year, from early March to mid June he was travelling on geological reconnaissance in central and north central Texas. His return route was south from Clay and Archer counties along the Permian-Pennsylvanian contact. He crossed the Colorado River between Coleman and McCulloch counties and, after a few days in Mason and Maynard counties, travelled directly to Austin, reaching there by mid-June. Accordingly, the type of *E. hispidum* must have been collected early in June 1861 near the crossing of the Colorado River in either Coleman or McCulloch county. This represents a southeastern extension in the generally recognized range of the species. This extension, however, is not inconsistent with the known distribution of *C. minima* and should be a cause for no great surprise. The species has heretofore been recognized as reaching its southeastern limit within Texas in Archer, Fisher, Mitchell and Val Verde counties.

It can be noted here that of the six members of the group *Texanae*, *C. minima* is the North American species most closely related to *C. mendocina* Johnston, the single South American member of this very natural and well defined group of species. Both species are characterized by bracteate cymes. *C. mendocina* is known only from the foothills of the Andes in western Mendoza, Argentina. It differs from *C. minima* in having the scorpioid cymes solitary and not in pairs, and in having evidently larger nutlets with both the large axial one and the smaller consimilar ones coarsely tuberculate in a similar manner. The lobes of the fruiting calyx of *C. mendocina* become prominent and thickened but to a much less degree than is common in *C. minima*.

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AN ANOMALY IN SOLANUM

Donovan S. Correll

Last year I published in Madroño (Vol. 14: 233) a species of *Solanum*, *S. Pennellii* Correll (Fig. 5), which I thought to be referrable to Series Juglandifolia in Section Tuberarium. In the meantime, I have heard from some of my colleagues who, unknown to me, had also been studying this plant. It is now my reconsidered opinion that this species does not belong in the Section Tuberarium and, as some of my colleagues have pointed out, it may not even belong in *Solanum* as long as *Lycopersicon* is maintained.

In publishing *S. Pennellii* I noted that it appears to be intermediate between *Solanum* and *Lycopersicon*, and there is still considerable doubt as to the true position of this plant.

The corolla and calyx of *S. Pennellii* are zygomorphic, a fact which I neglected to mention in the original description. According to Charles M. Rick, in some biotypes of *Lycopersicon*, subgenus *Eriopersicon*, there are some slight suggestions of bilateral symmetry. He says that in these the anther tubes lean and curve in the same plane as they bend in the pedicel and that the lobes of the corolla also seem to be slightly irregular, somewhat as they are in *Petunia* and *Nicotiana*. As shown by the illustration, this is quite descriptive of the flowers of *S. Pennellii*.

The floral bracts of *S. Pennellii* occur in species of *Lycopersicon* but are apparently unknown in *Solanum*. The anthers, however, which are held together in a cylindric column until they erupt their pollen do not have the apical sterile tissue which is so characteristic of species of *Lycopersicon*.

On February 16, 1958, Dr. Earl E. Smith and I collected *S. Pennellii* (No. P173) near sea level along the Panamerican Highway between Chala and Atico, Department of Arequipa, Peru. Only one colony was seen. Dr. Rick has seeds of this collection, and it is hoped that he will successfully grow plants so as to carry on some experimental work with this species. A sterile specimen of *Lycopersicon glandulosum* C. H. Mull. which was collected above Canta, Department Lima, Peru (*Correll, Smith and Ferreyra P287*) was unfortunately originally referred to *S. Pennellii*. This correction should be noted.

I wish to acknowledge the assistance given me by the National Science Foundation in the pursuit of my work on *Solanum*, Section Tuberarium, of which this is a part.

Fig. 5. *Solanum Pennellii* Correll (*Correll & Smith P173*): 1, upper branch, ×½; 2, leaf from lower part of plant, ×½; 3, inflorescence, ×1; 4, calyx, spread out, ×2; 5, corolla, spread out, ×1½; 6, stamens and pistil, spread out, ×2; 7, apical portion of anther, ventral view (note large pores), ×10. Drawn by Vivien Frazier.

AGRONOMIC STUDIES OF SOME BLUESTEM GRASSES[1]

E. O. Gangstad

INTRODUCTION

During the past several decades, a number of Asiatic or Old World bluestems have been introduced and have gained prominence as cultivated forage species in Texas. Taxonomic studies of two subgenera of *Andropogon*, *Bothriochloa* and *Dichanthium*, as represented by these species, were published in an earlier volume of the *Contributions* from Texas Research Foundation (17) by Jason R. Swallen. While the biotic potential of these introduced species remains to be determined, they have escaped to the wild and have become naturalized in various localities of Texas.

Previous studies of the tall grass prairie of North Central Texas have indicated that the most abundant native bluestem grasses are big bluestem (*A. Gerardi* Vitman), sand bluestem (*A. hallii* Hack.), and little bluestem (*A. scoparius* Michx.). Weedy species such as broomsedge (*A. virginicus* L.) and silver beardgrass (*A. saccharoides* Sw.) are also prevalent. Common associates are Indian grass (*Sorghastrum nutans* (L.) Nash), switchgrass (*Panicum virgatum* L.), and sideoats grama (*Bouteloua curtipendula* (Michx.) Torr.). (2, 10, 18, 19, 20).

While these grasses continue to be the more important forage species of the native range, Asiatic or Old World species of *Andropogon* (sometimes referred to the genera of *Bothriochloa* and *Dichanthium*) including King Ranch bluestem (*A. ischaemum* L.), Caucasian bluestem (*A. caucasicus* Trin.), silky bluestem (*A. sericeus* R. Br.), Angleton bluestem (*A. nodosus* (Willem.) Nash), Kleberg bluestem (*A. annulatus* Forsk.), and Medio bluestem (*A. caricosus* L.) have been utilized with varying degrees of success. (3, 4, 7, 10, 13, 17).

The proper utilization of native and introduced grasses, adapted to the climate and soils of Texas, has been studied in detail by various research groups. While the native species are probably better adapted than most introduced species, they have definite limitations in any forage program. They do not set seed well, the seed are not readily harvested and planted, and a long period of time is required to establish a stand. (4, 5, 7, 8, 9, 14).

Grazing results from these grasses have varied greatly with the time and place. In general, it appears that native species are more adapted to the open range under low grazing pressure, and the introduced species are more adapted for cultivated or tame pasture, under high grazing pressure. (5, 13, 14, 16).

[1] To the Richard M. Kleberg Research Foundation of Kingsville, Texas grateful acknowledgement is made for support of this project.

Nutritional studies indicate that under range conditions, supplemental feeding of protein and phosphorus often improves the yield of beef. Whenever the crude protein of the forage drops below 6–7%, beef yields are seriously limited. Similarly, if the phosphorus level in the forage goes below 0.12–0.13%, the animal does not receive an adequate supply. Utilization of legumes to improve the feeding quality of the forage has had limited success in the sub-humid southwest. (1, 6, 11, 12, 15).

The present study was made to observe some native and introduced bluestems under cultivated conditions on Houston black clay at Renner, Texas. Conventional methods of field plot technique, chemical and statistical analyses were used. Summary tables include the analysis of variance where interactions are important. Highly significant differences (L.S.D.—.01) are marked with a double asterisk; significant differences (L.S.D.—.05), with a single asterisk; and non-significant differences, NS.

Table 1

SUMMARY OF STAND, HEIGHT AND FORAGE YIELD OF NATIVE AND INTRODUCED BLUESTEM GRASSES GROWN IN A ROW NURSERY ON HOUSTON BLACK CLAY AT RENNER, TEXAS FOR THE YEARS 1954, 1955 AND 1956

Treatment[1]	Stand % [2]	Height inches[3]	Yield tons[4]
Variety			
KR bluestem	53	32	2.01**
Caucasian	75	31	1.58
Silky bluestem	47*	31	1.07
Silky bluestem[5]	63	31	1.13
Sand bluestem	80	35	1.47
Sand bluestem[6]	83	32	1.16
Little bluestem (check)	66	28	1.27
L.S.D.—.05	20	NS	.51
L.S.D.—.01	28		.70
Year			
1954	66	36*	1.38
1955	72	30	1.65
1956	63	29	1.15
L.S.D.—.05	NS	3	.34
L.S.D.—.01		4	.52
Mean	67	32	1.38

[1] Planted April 1953, in rows 3 feet apart and 20 feet long in four replications. Fertilized with 80 #/ac. P_2O_5 in 1953 and an annual application of 50 #/ac. N as ammonium sulfate.

[2] Stand as linear percent of row not counting skips less than one foot.

[3] Height of foliage as standing in the field.

[4] Yield in tons per acre oven dry forage adjusted to 100% stand, harvested as one cutting in July–August.

[5] Selected from an Australian introduction CPI 2130.

[6] Oklahoma selection W2, sand bluestem.

* Significant and ** highly significant difference from the check.

NURSERY TRIALS

Seed of varieties of materials under test were planted in rows 20 feet long and 3 feet apart with four replications, in April 1953. Phosphorus was applied as 400 pounds per acre of 20% superphosphate (80 pounds P_2O_5), worked into the soil before planting. Fifty pounds per acre of nitrogen as ammonium sulfate were applied each spring, broadcast on the surface shortly before the beginning of growth. The forage was harvested in 1954, 1955, and 1956 after cessation of spring growth, July to August, as one cutting. Samples were taken in May, July and December for chemical analysis. Results are summarized in Tables 1 and 2.

The stand of silky bluestem was significantly lower than other species studied. Persistence of this grass was slightly increased by selection, but further selection is necessary before a satisfactory strain can be obtained. The height of growth under these conditions was not significantly different for each species, but was significantly higher in 1954 than in 1955 and 1956. Annual differences of this kind are usually related to the rainfall during the early part of the growing season. The yield of forage was significantly

Table 2

SUMMARY OF THE MEAN VALUES OF CHEMICAL ANALYSIS OF NATIVE AND INTRODUCED BLUESTEM GRASSES HARVESTED IN MAY, JULY, AND DECEMBER, 1955–56, GROWN ON HOUSTON BLACK CLAY AT RENNER, TEXAS

Variety[1]	Crude Protein	Carbohydrates	Crude Fiber	Crude Fat	Phosphorus (P)	Calcium (Ca)	Potash (K)
KR bluestem	5.69	39.69	39.78	.99	.06	.46	1.29
Caucasian	5.38	40.35	39.78	1.36	.07	.47	1.02
Silky	5.67	39.45	39.76	1.33	.07	.45	1.16
Silky[2]	6.24	37.55	40.56	1.58	.08	.52	1.23
Sand	6.87	42.96	37.19	2.24	.08	.64	.98
Sand[3]	6.39	41.23	37.25	2.27	.08	.57	1.13
Little	6.12	40.24	38.69	1.35	.09	.49	1.12
Mean	6.05	40.22	39.01	1.59	.08	.51	1.13
L.S.D.—.05	NS	NS	NS	NS	NS	NS	NS
Dates of Harvest							
May	8.20	41.49	35.74	1.46	.10	.27	1.45
July	5.91**	37.25**	41.70*	1.44	.09	.62**	1.46
December	4.04**	41.94	39.62	1.88	.04	.67**	.50**
Analysis of Variance Mean Squares							
Varieties	1.56	16.53	10.65	1.43	.01	.03	.07
Dates	6.07**	93.41**	12.78*	.86	.02**	.67**	4.23**
Variety × dates	.97	11.86	4.97	2.23	.01	.03	.57

[1] Planted April 1953, in rows 3 feet apart and 20 feet long in four replications. Fertilized with 80 lbs. per acre P_2O_5 in 1953 and an annual application of 50 lbs. per acre N as ammonium sulfate.

[2] Selection from an Australian introduction CPI 2130.

[3] Oklahoma selection W2, sand bluestem.

* Significant and ** highly significant differences.

higher for King Ranch bluestem than for other bluestems and the total yield of forage was significantly higher in 1955 than in 1954 or 1956. This appears to be related to the stand, and to better moisture conditions for growth in the fall season of 1954 and late spring of 1955.

Differences in chemical composition for factors of feeding quality were not significant between entries for the means of May, July and December harvests, and were significant within harvests for fat and potassium only. Sand bluestem was observed to have somewhat higher fat and lower potassium than other bluestems.

The major differences in feeding values are related to the season of the year. A satisfactory level of 8.20 per cent protein was observed in May during the spring season of growth. Protein dropped down to a maintenance level of 5.91 per cent in July and 4.04 per cent or below maintenance level in December. This change in protein level is directly related to the vegetative state of growth and is affected by a seasonal supply of soil moisture. In this experiment the level of phosphorus in the forages was below the critical level at all dates of sampling, indicating that the initial application of phosphate in the fall of 1952 was not adequate for nutrition of the animal in 1955–56.

Table 3

PERCENT STAND OF GRASS IN 1955 AND YIELD AS TONS PER ACRE OVEN DRY FORAGE OF KING RANCH BLUESTEM FERTILIZED WITH NITROGEN AS AMMONIUM SULFATE AND PHOSPHORUS AS 20% SUPERPHOSPHATE FOR YEARS 1953, 1954, AND 1955 ON HOUSTON BLACK CLAY AT RENNER, TEXAS

Nitrogen lbs. N/A	Stand 1955	Yield, tons per acre dry forage			
		1953	1954	1955	Average
		No Phosphate			
0 (check)	85	.46	.31	1.03	.60
50	83	.57	1.03	1.81	1.14**
100	82	.50	1.63	2.09	1.41**
200	60	.75	1.96	1.95	1.55**
400	49**	.80	1.87	1.89	1.52**
Mean	72				1.24
L.S.D.—.05	22				.34
L.S.D.—.01	29				.47
		100 lbs. per Acre P_2O_5 as 20% Superphosphate			
0 (check)	84	.66	.38	1.30	.78
50	79	1.55	1.24	1.88	1.56
100	76	1.87	2.37	2.26	2.16**
200	75	2.00	2.90	2.34	2.41**
400	55**	2.06	2.63	2.17	2.28**
Mean	74				1.84
L.S.D.—.05	14				.83
L.S.D.—.01	19				1.16

* Significant and ** highly significant differences from the check.

YIELD RESPONSE TO NITROGEN AND PHOSPHORUS

Most forage grasses respond well to application of fertilizer and it is usually profitable to apply the amounts necessary for near maximum growth. This is particularly true of cultivated land when soil nutrients have been depleted by many years of cropping. In this respect, plantings of King Ranch bluestem are observed to decline in productivity several years after establishment while the stand is still good. A sod of King Ranch bluestem established on a terrace at the Foundation in 1950 showed such a decline in yield. This terrace received 400 pounds per acre of 20% superphosphate in 1949.

An experiment to study the effect of nitrogen and phosphorus to increase the yield was conducted for the years 1953–55 on this sod. Phosphate was applied at a rate of 0 and 500 pounds per acre of 20% superphosphate in March 1953. Nitrogen was applied at rates of 0, 50, 100, 200, and 400 pounds per acre as ammonium sulfate in March 1953, 1954, and 1955. Yield response was determined by a single harvest of forage in June of each year.

The results, as shown in Tables 3 and 4, indicate a significant response to both nitrogen and phosphorus. The optimum rate of nitrogen application was found to be about 100 pounds of nitrogen per acre. Higher rates tended to reduce the stand of grass and did not materially increase the yield of forage. The application of phosphate alone had little effect on yield but in combination with nitrogen, increased the yield about 50 per cent.

Table 4

SUMMARY OF CHEMICAL ANALYSES OF KING RANCH BLUESTEM FORAGE FOR NITROGEN AND PHOSPHORUS TREATMENTS ON HOUSTON BLACK CLAY, HARVESTED JUNE 21, 1955

Nitrogen lbs./acre	Protein (N × 6.25)	Carbohydrate N.F.E.	Crude Fiber	Crude Fat	Phosphorus (P)	Calcium (Ca)	Potash (K)
			No Phosphate				
0	8.37	39.06	35.31	1.55	.13	1.08	1.54
50	9.68*	38.32	34.95	1.50	.13	.95	1.62
100	10.20**	37.76	35.41	1.54	.12	.87	1.36
200	11.47**	37.97	33.61	1.77	.12	1.14	1.77
400	10.42**	38.80	34.86	1.40	.12	.93	1.63
			100 Lbs./Acre P_2O_5 as 20% Superphosphate				
0	8.59	38.77	35.17	1.76	.15*	1.11	1.27
50	8.90*	39.75	34.89	1.77	.16**	.91	1.44
100	10.59**	37.03	36.24	1.77	.15*	1.02	1.76
200	11.06**	36.92	35.90	1.70	.14*	1.13	1.54
400	11.17**	37.43	35.57	1.60	.13	1.12	1.42
L.S.D.—.05%	1.18	NS	NS	NS	.02	NS	NS
L.S.D.—.01%	1.60				.03		

* Significant and ** highly significant differences from the check.

The level of protein (N × 6.25) and phosphorus (P) in the forage were significantly increased by fertilizer application. As shown in Table 4, protein increased from 8.59% in the check plot to 10.59% at the 100 pound rate, an increase of about 25 per cent, and an estimated change in nutritive ratio from 1:12.1 to 1:8.1. Phosphorus was increased from .13% to .15%, an increase of about 15 per cent. This increase brings the phosphorus content of the forage slightly above the limit considered critical for livestock grazing.

GRASS-LEGUME ASSOCIATIONS

Grass-legume associations have generally been found more satisfactory than pure stands of either grasses or legumes for productive management of both soils and animals. On the blackland soils of North Central Texas, however, farmers and ranchers have found grass-legume associations difficult to maintain over a period of years. Commonly, a stand of grass does not persist in competition with a legume unless special conditions of man-

Table 5

SUMMARY OF WINTER ANNUAL, SUMMER ANNUAL, BIENNIAL AND PERENNIAL LEGUMES OVERSEEDED ON AN ESTABLISHED SOD OF KING RANCH BLUESTEM AT RENNER, TEXAS IN NOVEMBER, 1952

Variety and Source	Scientific Name
Winter Annuals	
Black medic clover[1]	*Medicago lupulina* L.
Rose clover[2]	*Trifolium hirtum* All.
Button clover[3]	*Medicago orbicularis* All.
Hairy vetch[4]	*Vicia villosa* Roth.
Bitter vetch[4]	*Vicia ervilia* Willd.
Austrian winter peas[4]	*Pisum arvense* L.
Singletary peas[4]	*Lathyrus hirsutus* L.
Crimson clover[2]	*Trifolium incarnatum* L.
Summer Annuals	
Hubam clover[5]	*Melilotus alba* var. *annua* Coe
Lespedeza (April planting)[6]	*Lespedeza stipulacea* Maxim.
Madrid (November planting)[5]	*Melilotus officinalis* Lam.
Biennials	
Kenland red clover[2]	*Trifolium pretense* L.
Cumberland red clover[2]	*Trifolium pretense* L.
Midland red clover[2]	*Trifolium pretense* L.
Perennial	
Bird's-foot Broadleaf trefoil[2]	*Lotus corniculatus* L.
Southwest common alfalfa[2]	*Medicago sativa* L.
Nomad alfalfa[2]	*Medicago sativa* L.

[1] R. E. Lambert & Sons, Darlington, Alabama.
[2] Northrup, King & Co., Berkeley, California.
[3] W. D. Mask, Bolivar, Tennessee.
[4] Robert Nicholson Seed Co., Dallas, Texas.
[5] Wells Brothers, Plano, Texas.
[6] Associated Seeds, Inc., San Antonio, Texas.

Table 6

THE PERSISTENCE AND EFFECT OF CERTAIN LEGUMES OVERSEEDED ON KING RANCH BLUESTEM SOD ON THE STAND OF LEGUMES AND GRASS ON HOUSTON BLACK CLAY AT RENNER, TEXAS, FOR 1953, 1954, AND 1955

Variety[1]	1953[2]		1954[3]		1955[4]	
	Legume	Grass	Legume	Grass	Legume	Grass
Winter Annuals						
Black medic clover	1	1	10	28	24	66*
Rose clover	1	1	11	19	31	66*
Button clover	1	1	15	26	40**	46**
Hairy vetch	3	1	7	19	0	88
Bitter vetch	3	1	5	23	0	75
Austrian winter peas	3	1	5	25	0	82
Singletary peas	3	1	4	20	0	86
Crimson clover	3	1	1	16	0	84
Summer Annuals						
Hubam clover	2	1	2	15	0	83
Lespedeza (April planting)	2	1	1	21	0	86
Madrid (Nov. planting)	2	1	4	33	0	82
Biennials						
Kenland red clover	1	1	2	39	0	79
Cumberland red clover	1	1	1	24	0	82
Midland red clover	1	1	1	24	0	75
Perennial						
Broadleaf trefoil	2	1	1	35	0	88
Common alfalfa	1	1	43**	19	40**	38**
Nomad alfalfa	1	1	52**	16	64**	31**
Check (KR bluestem)	0	1		14		85
L.S.D.—.05			14	NS	34	16
L.S.D.—.01			18	NS	40	22

[1] Overseeded, Nov. 1952, 10 × 12 ft. plots, 4 replications at 8 pounds per acre.
[2] Stand evaluated by visual observation; 1 = good, 2 = fair, 3 = poor.
[3] Percent stand evaluated by linear quadrat count.
[4] Percent stand evaluated by square yard quadrat count.
* Significant and ** highly significant difference from the check.

agement are observed. One of the important factors for the maintenance of good grass-legume associations is the selection of grass-legume combinations that are ecologically compatible.

An experiment to study the compatability of King Ranch bluestem with winter annual, summer annual, biennial and perennial legumes listed in Table 5 was set out in 1952 by overseeding an established sod with these legumes. Legumes were seeded at a rate of 8 pounds per acre in November. Forage yields were determined by a single harvest in June of 1953, 1954, and 1955. Chemical analyses of the forages were made in 1955 according to AOAC methods.

Data for the persistence of the legumes and their effect on the stand of

Table 7

YIELD OF DRY FORAGE OF KING RANCH BLUESTEM SOD ON HOUSTON BLACK CLAY AT RENNER, TEXAS, OVERSEEDED WITH LEGUMES NOVEMBER 1952, AND HARVESTED JUNE 1953, 1954, AND 1955

Legume variety[1]	Tons per acre dry forage			
	1953	1954	1955	Ave.
Winter Annuals				
Black medic clover	1.16	1.52	.90	1.19
Rose clover	1.24	1.64	.68	1.19
Button clover	1.51	1.96*	.68	1.38
Hairy vetch	1.12	1.29	.79	1.07
Bitter vetch	1.11	1.50	.67	1.09
Austrian winter peas	1.18	1.43	.73	1.11
Singletary peas	1.24	1.67	.88	1.26
Crimson clover	1.14	1.54	.81	1.16
Summer Annuals				
Hubam clover	.94	1.15	.83	.97
Korean lespedeza (April planting)	.94	1.30	.73	.99
Madrid clover (Nov. planting)	.98	1.28	.82	1.03
Biennial				
Kenland red clover	.86	1.30	.89	1.02
Cumberland red clover	1.17	1.41	.90	1.16
Midland red clover	1.22	1.25	.77	1.08
Perennial				
Broadleaf trefoil	1.06	1.40	.78	1.08
Common alfalfa	1.27	1.60	.99*	1.29
Nomad alfalfa	1.14	1.73	1.04**	1.30
Check (KR bluestem)	1.04	1.42	.83	1.10
L.S.D.—.05	NS	.44	.14	NS
L.S.D.—.01		.60	.18	

[1] Overseeded in 10 × 12 foot plots with four replications. Harvested as one cutting at 2–3 inch cutting height. Yield of forage computed as tons per acre oven dry weight.

* Significant and ** highly significant difference from the check.

grass are given in Table 6. The yields of forage are summarized in Table 7. Chemical analyses of the forages for the 1955 harvest are presented in Table 8.

Hairy vetch, bitter vetch, Austrian winter peas, crimson clover, Korean lespedeza, Madrid clover, red clover and bird's-foot trefoil did not naturally reseed. Black medic, rose clover and button clover reseeded naturally. Southwest common and Nomad alfalfa persisted well. Under conditions of the experiment, button clover and alfalfa seriously reduced the stand of grass.

The forage yields in 1953 did not differ significantly. In 1954, button clover increased the yield about 40% and in 1955, alfalfa increased the

Table 8

SUMMARY OF CHEMICAL ANALYSES OF FORAGE FOR KING RANCH BLUESTEM-LEGUME ASSOCIATIONS ON HOUSTON BLACK CLAY AT RENNER, TEXAS FOR JUNE 1955 HARVEST[1]

Variety	Crude Protein	Carbohydrates	Crude Fiber	Crude Fat	Phosphorus (P)	Calcium (Ca)	Potash (K)
Winter Annual							
Black medic clover	9.41**	38.83	32.32	1.97	.15	1.14	1.39
Rose clover	8.94**	38.47	33.58	1.88	.16	1.03	1.36
Button clover	9.06**	39.46	33.54	2.13	.16	1.29	1.35
Hairy vetch	7.39	39.55	33.20	2.03	.14	1.03	1.49
Bitter vetch	7.84	38.71	33.89	2.34	.15	1.29	1.44
Austrian winter peas	7.40	39.64	34.00	1.87	.15	.92	1.39
Singletary peas	7.23	40.08	33.45	2.16	.15	.82	1.35
Crimson clover	7.50	38.33	34.21	2.34	.15	.79	1.49
Summer Annuals							
Hubam clover	7.17	38.85	34.01	1.94	.14	1.08	1.32
Korean lespedeza	6.59	38.22	34.64	1.95	.14	1.07	1.43
Madrid clover	6.89	38.43	34.60	2.18	.14	.76	1.40
Biennial							
Kenland red clover	7.26	39.57	33.61	2.27	.14	.92	1.32
Cumberland red clover	7.76	39.81	33.23	2.44	.15	1.11	1.53
Midland red clover	7.65	37.31	34.25	2.04	.14	1.08	1.45
Perennial							
Broadleaf trefoil	7.68	38.13	34.15	2.11	.15	1.03	1.39
Common alfalfa	11.34**	36.07	31.57	2.18	.15	1.39	1.54
Nomad alfalfa	11.32**	35.30	32.24	2.03	.14	1.30	1.65
Check (KR bluestem)	6.93	39.42	34.70	1.91	.13	.83	1.38
Mean	8.08	38.56	33.56	2.10	.14	1.05	1.43
L.S.D.—.05	1.48	NS	NS	NS	NS	NS	NS
L.S.D.—.01	1.98						

[1] Chemical analysis by standard methods of the AOAC for feed analysis.
** Highly significant difference from the check.

yield about 20%. General observations would indicate that actual increases in yield are dependent upon the immediate rainfall distribution as related to the growing season of a particular legume.

A study of the chemical composition of the forage demonstrated a significant increase in the per cent protein by growing legumes in association with the grass. Crude protein was increased from about 7 per cent in the check plot to 9 per cent in the annual legume associations and 11 per cent in the perennial legume associations. These values will, of course, vary with the season of the year according to the vegetative growth of the grass and legume, but are probably indicative of the average values to be expected.

GRASS-LEGUME RESPONSE TO FERTILITY

Further work on grass-legume associations with King Ranch bluestem was undertaken by overseeding an established sod with southwest common alfalfa and button clover and superimposing factorial treatments of nitrogen and phosphorus. It was presumed that a grass-legume association might be stabilized by the proper combination of nitrogen and phosphorus, assuming that nitrogen would favor the growth of grass and phosphorus would favor the growth of the legume.

The experiment was set out in October 1954 with five replicates, split for legumes in rows and NP factorial combinations in columns, with whole plots 14 × 90 feet for legumes and 10 × 42 feet for fertility treatments, and sub plots 10 × 14 feet. Legumes were seeded in November 1954 at a rate of 8 pounds per acre. Phosphate was applied annually in October as 20 per cent superphosphate and nitrogen in March as ammonium sulfate.

The forage yields of this study are given in Table 9 for 1955, 1956, and 1957 years of harvest. A significant increase in yield was obtained from the first increment of phosphorus, 90 pounds P_2O_5 per acre, but not from the second increment. Significant increases in yield were also obtained from the first increment of nitrogen, 50 pounds per acre, and from the second increment of nitrogen in combination with phosphate. These results indicate that when nitrogen is applied at a rate above 50 pounds per acre, additional phosphate is required for good utilization.

The effect of legumes on yield is found to vary with years. In dry seasons such as 1955 or 1956, legumes tended to reduce the total yield harvested in June, probably by greater depletion of soil moisture during the winter season. In a wet year such as 1957, legumes tend to increase the yield.

The effects of legumes and fertilizers on the stand of grass are summarized in Table 10 for years 1955, 1956 and 1957. The nitrogen treatment reduced the stand of King Ranch bluestem at the 100 pound rate at the five per cent level of significance. This reduction in stand is relatively small and is compensated by greater yield.

Alfalfa reduced the stand of grass from 59 per cent in the check to 54 per cent in 1955, and to 48 per cent in 1957. Nitrogen treatments on these plots stimulated the growth of the legume more than the grass. The effect of phosphorus treatments on the stand of grass of these plots was not significant.

Button clover seriously reduced the stand of grass to 53 per cent in 1955, to 34 per cent in 1956, and to 13 per cent in 1957. The treatments of nitrogen on button clover plots did not have a significant effect but the phosphorus treatments were highly significant. The stand was reduced from an average stand of 42 per cent for no phosphorus to 29 per cent for an annual application of 90 pounds of P_2O_5 per acre. There was a significant interaction of nitrogen and phosphorus to years as the combination favored the growth of button clover in progressive years.

This effect of button clover appears to be directly related to the stand of button clover and its ability to reseed. Nitrogen and phosphorus treat-

Table 9

SUMMARY OF FORAGE YIELDS IN TONS PER ACRE OVEN DRY FORAGE FROM FACTORIAL TREATMENTS OF NITROGEN AND PHOSPHORUS ON THE YIELD OF KING RANCH BLUESTEM AND OF ALFALFA AND BUTTON CLOVER OVERSEEDED ON THE ESTABLISHED SOD IN NOVEMBER 1954, HARVESTED AS ONE CUTTING IN MAY-JUNE, 1955, 1956 AND 1957

Treatment[1]	Yield, tons per acre dry forage		
	Phosphorus (lbs./acre P_2O_5)		
Nitrogen (lbs./acre)	0	90	180
0	.87	1.05	1.04
50	1.12*	1.15*	1.14*
100	1.06	1.33**	1.34**
Year	1955	1956	1957
King Ranch bluestem	1.15*	.90	1.46
S.W. common alfalfa	1.07	.71	1.39
Button clover	.94	.83	1.63**
L.S.D.—.05	.21	NS	.07
L.S.D.—.01	—	—	.13

Analysis of Variance

Source	DF	SS	MS	F
Legumes	2	.8778	.4389	2.77 NS
Error (RL)	8	1.2667	.1583	
Nitrogen	2	4.2912	2.1456	25.18**
Phosphorus	2	2.3027	1.1514	13.51**
NP	4	.9774	.2444	2.87*
Error (RT)	32	2.7270	.0852	
LN	4	.0693	.0173	.33 NS
LP	4	.1788	.0447	.85 NS
Error (R(LNLPLNP))	64	3.3585	.0525	
Years	2	32.3857	16.1928	44.16**
Error (RY)	8	2.9334	.3667	
LY	4	2.2671	.5667	1.05 NS
Error (RLY)	16	8.6348	.5396	

[1] Legumes were planted in strips with a standard grain drill. Phosphorus was applied as 20% superphosphate in October and nitrogen applied as ammonium sulfate in March on the sod surface with an E-Z flow spreader. The forage was harvested by cutting in the field with a standard sickle bar tractor mower. Green weights were taken in the field and subsamples taken for moisture determination.

* Significant and ** highly significant differences.

ments on this soil improve the set of seed and thus increase competition to the grass. While low rates of seeding will reduce the immediate competition to King Ranch bluestem, management practices to reduce natural reseeding of the button clover are necessary to maintain this grass-legume association.

Table 10

SUMMARY OF STAND AS PERCENT COVER OF FACTORIAL TREATMENTS OF NITROGEN AND PHOSPHORUS ON THE STAND OF KING RANCH BLUESTEM AND OF ALFALFA AND BUTTON CLOVER OVERSEEDED ON AN ESTABLISHED SOD IN NOVEMBER 1954, HARVESTED AS ONE CUTTING IN MAY-JUNE, 1955, 1956, AND 1957

Treatment[1]	King Ranch bluestem	Alfalfa KR bluestem	Button clover KR bluestem
Nitrogen lbs./acre			
0	67	60	37
50	61	45**	33
100	54*	49**	30
Phosphorus lbs./acre			
0	63	56	42
90	60	52	29**
180	59	48	28**
Years			
1955	59	54	53
1956	60	53	34**
1957	63	48	13**
Mean	61	52	33
Analysis of Variance Mean Squares			
Nitrogen	1,705*	2,618**	458
Phosphorus	183	595	2,659**
NP	486	384	267
Years	258	425	17,784**
YN	280	159	261**
YP	407*	206	1,626**
YNP	80	502**	340**

[1] Legumes were planted in strips with a standard grain drill. Phosphorus was applied as 20% superphosphate in October and nitrogen applied as ammonium sulfate in March on the sod surface with a standard E-Z flow spreader of each year.

* Significant and ** highly significant differences.

GRASS ASSOCIATIONS

The dominance of a certain ecospecies or ecotype is known to vary with a particular set of environmental conditions. Climatic, edaphatic and cultural conditions such as grazing, clipping, burning, cultivation, etc., determine the adaptive persistence of a particular ecotype and its predominance in a plant community.

It has been observed that King Ranch bluestem tends to predominate when planted in association with other grasses in cultivated pastures. Experimental study of this situation was undertaken by planting King Ranch bluestem in association with three different short grasses and three different tall grasses. The seed were planted by hand on a clean-tilled seedbed in rows 7 inches apart and plots 15 × 20 feet with two replications in a 3 × 3 factorial design. The area was watered to provide for uniform

Table 11

SUMMARY OF PERCENT YIELD OF KING RANCH BLUESTEM GRASS AND YIELD OF TOTAL FORAGE OF KING RANCH BLUESTEM, GROWN IN ASSOCIATION WITH SOME SHORT AND TALL GRASSES, AS THE MEAN OF 1956 AND 1957 HARVEST SEASONS

Grass association[1]	Buffalo grass	Blue grama grass	Bermuda grass
	Percent yield of King Ranch bluestem		
Indian grass	100	94	67**
Switchgrass	100	93	40**
Blue panic grass	23**	33**	26**
	Total yield, tons per acre oven dry forage		
Indian grass	1.46	1.07	1.80
Switchgrass	1.56	1.94	1.05
Blue panic grass	1.86	1.55	1.39

[1] Planted in April 1955 on moderately fertile Houston black clay at Renner, Texas. The seed were planted by hand in a shallow furrow on a clean tilled seedbed at a rate of approximately 3 pounds per acre each of pure live seed. Plots were 15 × 20 feet with two replicates in a 3 × 3 factorial design. Each plot contained a combination of King Ranch bluestem with one short and one tall grass. Harvests were made in July with a small power mower. Percent yield of King Ranch bluestem was determined by separation of King Ranch bluestem from a dry weight sample of one to two pounds green forage per plot.

* Significant and ** highly significant.

seedling development and was clipped in April, July and September to simulate periodic grazing. The per cent yield of King Ranch bluestem and total yield of forage are summarized in Table 11 for the May-June growth harvested in early July each year.

King Ranch bluestem was found to dominate and contribute nearly 100% of the forage yield for associations with Buffalo grass [*Buchloe dactyloides* (Nutt.) Engelm.], blue grama grass [*Bouteloua gracilis* (H.B.K.) Lag. ex Steud.] Indian grass [*Sorghastrum nutans* (L.) Nash.] and switchgrass (*Panicum virgatum* L.). It is found to persist in association with Bermuda grass [*Cynodon dactylon* (L.) Pers.] and blue panic grass (*Panicum antidotale* Retz.) and to contribute a substantial portion of the forage yield. Under conditions of the experiment, differences in total forage yield among different grass associations were not statistically significant. These results do not indicate any particular advantage of planting King Ranch bluestem in association with the above grasses.

GRAZING TRIALS

King Ranch bluestem has been quite widely used throughout Central and North Central Texas. It has been found fairly well adapted for this area and has been planted and maintained on poor soils that had previously supported little growth. Among those who have used it, there is a wide variety of opinion as to its value in a grazing program, but for much of this area, there are few other perennial grasses to recommend.

King Ranch bluestem has the advantage that it is more readily established than other bluestems and has been able to persist under less favorable conditions. It has the disadvantage that it is somewhat low in protein and there is little vegetative growth during the hot dry summer season, July through August. Depending upon the actual rainfall and soil moisture supply, there is usually a flush period of spring growth during May-June, and a fall period of growth during September–October.

An experimental pasture of King Ranch bluestem in a mixture with El Reno side-oats grama [*Bouteloua curtipendula* (Michx.) Torr.], Blackwell switchgrass (*Panicum virgatum* L.) and domestic Dallis grass (*Paspalum dilatatum* Poir.) was established on the Foundation in the spring of 1950. The grasses were seeded at a rate of 4 pounds per acre each. A good stand was obtained in which King Ranch bluestem was the dominant grass and a seed yield of 50 pounds per acre was harvested the first season of growth. The pasture was fertilized by topdressing with 50 pounds per acre of nitrogen each spring.

For the period 1951–54 the pasture was periodically grazed, adjusting the stocking rate and period of grazing according to the vegetative growth. An average grazing yield of 279 pounds live weight gain per acre, 142 steer grazing days per acre and an average gain of 1.99 pounds per steer per day were obtained for the 1951–53 grazing seasons. In 1954 this pasture produced 244 pounds live weight gain, 121 grazing days and 2.06 pounds per steer per day. In 1955, King Ranch bluestem on a different site produced 155 pounds live weight gain, 103 steer grazing days and an average daily gain of 1.45 pounds per steer. The lower yields observed in 1954 and 1955 are largely due to extended drouth and somewhat poorer stands of grass.

During this period of study, Dallis grass and switchgrass were selectively grazed and did not persist in the stand. Side-oats grama persisted well but was not a major component. Sweet clover and alfalfa overseeded on King Ranch bluestem were detrimental to the stand of grass but did not persist with continued grazing. A natural invasion of button clover was observed, but aggressive spread of this legume was limited by controlled grazing.

Further studies on grass-legume associations for grazing were initiated by overseeding an established sod of King Ranch bluestem and side-oats grama with rose clover. The pasture was topdressed with 200 pounds per acre of ammonium phosphate (13–39–0) and seeded at a rate of 15 pounds per acre in October 1956. The stand of grass was periodically clipped during 1956 and 1957 but was not grazed. Rose clover was moderately established in 1957 and produced a nearly complete cover in 1958. During this period of time the stand of grass was maintained at 50 to 60 per cent ground cover, about equally distributed between King Ranch bluestem and side-oats grama (Figures 6 and 7).

Because of its ability to become established and persist under limiting conditions for growth, King Ranch bluestem is probably best utilized on the more drouthy and less fertile lands of North Central Texas. It can be planted with equipment designed to handle fluffy seeds. Where there is danger of serious weed competition, planting in rows and cultivation during

Fig. 6 (upper). Rose clover overseeded on King Ranch bluestem and side-oats grama in October 1956, photographed in May 1958. The clover made nearly complete cover.

Fig. 7 (lower). Growth of King Ranch bluestem in September 1958, following extensive growth of rose clover. Note there is no apparent loss of stand.

the first season is recommended. A rate of 2½–3½ pounds of pure live seed per acre, planted on a clean tilled seed bed, March through April, has been found satisfactory. Under average conditions, a good stand will be obtained the first year.

Seeding of legumes should not be attempted until the second year and may be delayed further, if the stand is poor. Competition of legumes to grass is much reduced, under grazing. Where the intensity of grazing can be properly managed, the more aggressive growing legumes such as button clover and alfalfa may be used; but where conditions do not permit this control, the less aggressive legumes, such as black medic and rose clover are likely to prove more satisfactory. Other annual legumes such as vetch or sweet clover may be used by overseeding each year.

In practice it has been observed that heavy sods of King Ranch bluestem, when plowed up for rotation to other crops, are not readily worked or decomposed for the planting. Experimentally, it has been possible to fertilize heavily with phosphate and overseed heavily with a legume to bring about a natural decomposition of the fiberous roots and reduce the stand of grass to a point where it can be easily tilled for other crops.

SUMMARY AND CONCLUSIONS

A study of several native and introduced bluestems indicated that King Ranch bluestem will give somewhat higher yields of forage than others and it has been found to persist under very limiting conditions over an extended period of drouth. Differences in forage quality among bluestem grasses were small and in most cases statistically nonsignificant. Forage of good quality was harvested in May but quality was poor in July and December.

King Ranch bluestem responded to nitrogen and phosphate fertilization. Optimal yield was obtained for years 1953–1955 with an annual application of 100 pounds per acre of nitrogen where a preliminary treatment of 100 pounds per acre of phosphate had been applied. Fertilization increased the yield about 50 per cent, the protein content about 25 per cent and the phosphorus content about 15 per cent.

Black medic and rose clover reseeded well in association with King Ranch bluestem without seriously reducing the stand of grass. Button clover reseeded well and alfalfa persisted well in association with King Ranch bluestem, but these legumes severely reduced the stand of grass. The protein content of the forage was improved by legume associations from about 7 per cent in the check to 9 per cent in the annual legume associations to about 11 per cent in the perennial legume associations.

It was not possible to experimentally reduce the deleterious effect of alfalfa and button clover on the stand of King Ranch bluestem by nitrogen and phosphate fertilization. These treatments stimulated the growth of the legume more than the growth of the grass.

Experimentally, high fertilization with phosphate and heavy overseeding with these legumes brought about rapid elimination of the grass and good decomposition of the sod, leaving the soil in good tilth.

Grazing trials on King Ranch bluestem gave relatively high yields of beef, 247 pounds per acre for 1950–1955. On these pastures phosphate was applied at the rate of 400 pounds of 20% superphosphate for establishment and 50 pounds per acre of nitrogen, annually. The competition of legumes with grass under grazing was lower than under harvest of forage for hay.

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AN INTERESTING HOLACANTHOID PLANT IN TEXAS

Donovan S. Correll

In 1941, Muller (Madroño 6: 128–132) published an account of the holacanthoid plants of North America. In the same paper he described *Holacantha Stewartii* Muller (Simarubaceae) from western Coahuila and northern Zacatecas. He also noted that the only other species in this genus, *H. Emoryi* A. Gray, is confined to Arizona and southern California.

Recently Dr. Ivan M. Johnston and I found *H. Stewartii* in Presidio County, Texas. Several fruiting and sterile plants were observed to grow at various elevations on the precipitous walls of an extremely narrow canyon that cut through a mountain along the Rio Grande. According to Muller's findings, this is a most unusual habitat for this species. He stated that with the exception of two collections that grew in rocky arroyo sites, all specimens which he cited were obtained from deep, heavy silt flats.

The canyon in which this species grew in Presidio County is vividly described by Parry in the United States and Mexican Boundary Survey (Vol. 1, part 2, p. 53. 1857).

In addition to the Presidio collection of *H. Stewartii*, a sterile specimen collected by B. H. Warnock in the Paint Gap Hills of Brewster County, Texas, is apparently referrable to this species. As far as I know, *H. Stewartii* has not been reported before from the United States.

It may be of interest to note that Dr. Johnston and I also collected *H. Stewartii* at Julimes, Chihuahua, Mexico (*Correll & Johnston 21560*, LL) where it grew on an alluvial terrace along the Río Conchos.

TEXAS: Presidio Co., shrubby plants hanging vine-like from cliffs in narrow canyon through mountain, 15 miles southeast of Redford, along river road, May 14, 1959, *D. S. Correll & I. M. Johnston 21918* (LL); Brewster Co., infrequent shrub, hill sides, Paint Gap Hills, Big Bend National Park, alt. 3500 ft., August 12, 1955, *B. H. Warnock 12903* (LL).

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A NEW COTTONWOOD FROM TEXAS

Donovan S. Correll

During a study of Texas *Populus*, which is to be published with C. R. Ball's *Salix* manuscript as a part of the FLORA OF TEXAS, the following apparently endemic species was discovered.

Populus Hinckleyana Correll, sp. nov. Fig. 8.

Arbor ad 20 m. alta; caudex albo-glaucus; lamina foliorum suborbiculo-ovata vel triangulo-ovata, basi truncata vel rotunda, apice acuta vel abrupte acuminata, marginibus serratis; petioli subteres supra canaliculati; amenta pistilata multa abbreviata minus quam 5 cm. longa, rhachibus callosis et crassis; disci florum sessilis; fructus parvi 2–3 mm. diam., orbiculares.

Tree up to 20 m. tall, with smooth light gray bark which is deeply furrowed on the lower part of the trunk and light gray to tan-colored bark on the young growth; twigs downy-puberulent, sometimes with some longer whitish spreading hairs; buds ellipsoid, puberulous and resinous, orange-brown, 1–1.5 cm. long; leaf-blades rather thin, essentially glabrous or sometimes slightly puberulent on the margins and on the veins on the lower surface, suborbicular-ovate to broadly deltoid-ovate, truncate to broadly rounded at the base, acute to abruptly acuminate at the apex, rather finely and irregularly (almost doubly) serrate on the margins (except at the very base and apex), darker green on the upper surface than the lower, up to 7 cm. long and 6.5 cm. wide, usually smaller; petioles subterete, channeled or somewhat flattened on the upper side, downy-puberulent, with age becoming glabrate, 2–4 (mostly less than 3) cm. long; pistillate aments much-abbreviated, with the rachis thick and rigid, less than 5 cm. long, the cup-shaped floral disc sessile and about 3 mm. in diameter; fruits orbicular, pitted-rugose, 2–3 mm. in diameter, 2- to 3-valved; seeds not fully developed.

TEXAS: Jeff Davis County, wide floodplain with some moisture, in and close to the Davis Mountains, 1650 m. alt., desert scrub except for these cottonwoods, Goat Canyon, George Jones Ranch, April 11, 1937, *L. C. Hinckley s. n.* (NY No. 2267, type; GH, isotype); Goat Canyon, Mt. Livermore, Davis Mountains, 5,500 ft. alt., May 28, 1936, *Hinckley s. n.* (F, NY, TEX); in yard at George Jones ranchhouse, mouth of Merrill's (Goat) Canyon, April 1, 1959, *D. S. Correll, B. H. Warnock & M. C. Johnston 20618* (LL); same locality, May 15, 1959 *Correll & I. M. Johnston 21949* (LL).

The small suborbicular-ovate to broadly deltoid-ovate leaves and much-abbreviated pistillate aments, with their thick, rigid rachis and sessile

Fig. 8. *Populus Hinckleyana* Correll (type specimen): 1, leaves and pistillate ament, natural size; 2, fruit and floral disc, about ×3. Illustrated by Phoebejane Horning.

floral discs, are characteristics which distinguish this species from the allied *P. angustifolia* James and *P. acuminata* Rydb. The leaves resemble in size and shape some specimens of *P. tremuloides* Michx.

Unsuccessful efforts have been made to relocate the trees from which Hinckley obtained the original collections. Some fine trees of *P. arizonica*

Sarg. were located in the lower part of Merrill Canyon, formerly called Goat Canyon, but, except for two young trees under cultivation at the old Jones ranch-house, no *P. Hinckleyana* was found. The cultivated trees, when examined, were not in flower or fruit. At the time of flowering and fruiting next spring a further effort will be made to locate these trees, at which time Merrill's Canyon will be followed up into the Livermore Peak region of the Davis Mountains.

It is a pleasure to name this tree for its discoverer. The fact that Hinckley made a second effort to obtain better material of this new tree attests to the belief that he realized it was unique—a not unusual characteristic of this able collector.

The following nomenclatural change was found to be necessary during the course of my work.

Populus Sargentii Dode var. **texana** (Sarg.) Correll, comb. nov.

Populus texana Sarg., Bot. Gaz. 67: 211. 1919.

Except for the fact that var. *texana* lacks the characteristic glands found at the junction of the leaf-blades and petioles, it could be referred to typical *P. Sargentii*. Variety *texana* is found scattered over the Plains Country in the same area of distribution as that of typical *P. Sargentii*.

NOTE

Verbena Cloveri Moldenke forma **alba** Lundell, forma nov.

Herba annua, erecta; corolla alba.

TEXAS: Zapata County, off U. S. highway 83, 8 miles south of Zapata, in open brush, March 31, 1958, *C. L. Lundell & Amelia A. Lundell 15055* (type, LL).

The new form differs in having a pure white corolla. In the typical form of the species, the corolla is bluish-lavender.

TEXAS RESEARCH FOUNDATION ACQUIRES THE SIDNEY FAY BLAKE LIBRARY AND HERBARIUM

Helen B. Correll

In the spring of 1959 Texas Research Foundation purchased from Dr. Sidney Fay Blake his biology library and herbarium. The herbarium contains approximately 35,000 specimens, mostly Compositae. According to Dr. Blake, who was a world authority on this family, at least 5,000 species in 500 genera are represented in the Compositae. These are from all parts of the world, but especially from North America and Europe. It was undoubtedly one of the largest and most authoritative private collections of this important family in existence.

The herbarium contains not only Dr. Blake's personal collection, but also material which he had obtained through exchange, purchase or for identification. Some of the specimens are duplicates of material which was destroyed in the Berlin-Dahlem herbarium during World War II, hence they are probably the only specimens of these now extant. A few actual types are included as well as approximately 150 isotypes.

The library contains many periodicals and also a large and valuable collection of reprints of publications concerning plants of the family Compositae.

At the time the library and herbarium were shipped to Texas, Dr. Blake reserved on loan certain materials upon which he planned to continue work. He hoped to publish a flora of Stoughton, Massachusetts, his birthplace, for which he had collected data for many years. He was working on the second volume of his "Floras of the World" when death took him suddenly on December 31, 1959.

The acquisition by Texas Research Foundation of Dr. Blake's library and herbarium was made possible through a grant from the McDermott Foundation of Dallas.

PLANTAE MAYANAE—I

NOTES ON COLLECTIONS FROM THE LOWLANDS OF GUATEMALA

CYRUS LONGWORTH LUNDELL

Since the initiation of the Tikal Project by the University of Pennsylvania Museum in 1956, facilities have been developed at Tikal to expedite botanical and related studies in the Department of Peten.

Although Mr. O. F. Cook and Mr. R. D. Martin made a plant collection in the area in 1922, the first extensive series was secured by Professor H. H. Bartlett in 1931 at Uaxactun.

My earliest investigations in Peten were made in 1932 while connected with the chicle industry, and as Director of the 1933 expedition of the University of Michigan and the Carnegie Institution of Washington to Guatemala. Results of these investigations were published in 1937 in *The Vegetation of Peten* (Carnegie Institution of Washington, Publication 478) in which I summarized what was known about the physiographic ecology, flora and agriculture.

The Department of Peten and adjacent lowlands afford special opportunities for studies to reconstruct the background of the ancient Maya culture with particular reference to plant resources and agriculture. A grant from The Rockefeller Foundation for an "evaluation of the ancient agriculture of the lowland Maya area of Guatemala" has made possible the renewal of my research in this area. With initial efforts centered at Tikal, an inventory of the plant resources was initiated on January 25, 1959, the economic plants being of immediate concern, particularly the progenitors of cultivated crops and others of potential usefulness. With the aid of my resident assistant, Mr. Elias Contreras, collecting in Peten has been carried out on a continuous basis through 1959.

In 1933 Mr. Percy H. Gentle began work under my sponsorship in British Honduras. His botanical exploration of the Colony continued until May 7, 1958, when failing health brought his career to an end. He died at Stann Creek on August 16, 1958. Over this span of nearly twenty six years, Gentle collected continuously, taking as many as twenty specimens of each number. His series totals 9755. In the period 1944–1958, all of his collections were accumulated at Renner.

The study of 1959 collections from Peten, and the accumulated Gentle material, which together represent possibly half of all collections made in British Honduras and Peten since botanical exploration started in the 1920's, will greatly increase our knowledge of the plants of this interesting region.

The series of papers, *Plantae Mayanae*, will deal with the plant resources of the Maya area, a continuation of the earlier *Botany of the Maya Area: Miscellaneous Papers* (Carnegie Institution of Washington, Publications 461 and 522).

ULMACEAE

Celtis tikalana Lundell, sp. nov.

Arbor, 1 m. diam., 25 m. alta; folia petiolata, petiolo 7–14 mm. longo; lamina sericea, chartacea, lanceolata vel ovato-lanceolata, 7.5–14 cm. longa, 2.5–5 cm. lata, apice caudato-acuminata, basi 3-nervia, inaequalia, acuta, margine crenato-serrata; cymae ad 1.5 cm. longae; pedicelli fructiferi ad 6 mm. longi; ovarium glabrum.

A large tree, 1 m. diam., 25 m. high; branchlets lenticellate, pubescent with silvery hairs, slender. Leaves petiolate, the petioles 7 to 14 mm. long, canaliculate, pubescent, the silvery hairs subappressed, the stipules caducous early. Leaf blades chartaceous, lanceolate or ovate-lanceolate, 7.5 to 14 cm. long, 2.5 to 5 cm. wide, apex caudate-acuminate, base 3-nerved, strongly inaequilateral, acute, margin conspicuously crenate-serrate, sericeous on lower surface, sparsely so on upper surface. Axillary cymes small, up to 1.5 cm. long, pubescent, the hairs silvery, subappressed, fruiting pedicels up to 6 mm. long, jointed at apex. Perianth 5-parted, the segments imbricate, broadly obovate or elliptic, subequal, 2 to 2.3 mm. long, ciliate, almost glabrous otherwise. Torus pilose. Stamens glabrous. Ovary sessile, glabrous except for a few appressed hairs at base of style, the style bifid to base, the branches linear. Immature drupes ellipsoid, up to 5 mm. long.

GUATEMALA: Department of Peten, Tikal, in *ramonal*, June 15, 1959, *C. L. Lundell 16083* (type, LL), flowers greenish, "*capulin sylvestre*".

The large caudate-acuminate leaves strongly inaequilateral, 3-nerved and acute at base, the conspicuously crenate-serrate leaf margins, and the fine sericeous indumentum distinguish the species. Its affinity is to *C. petenensis* Lundell, which has smaller membranaceous pilose leaves altogether different in aspect from those of *C. tikalana*.

C. petenensis was relegated to synonymy under *C. trinervia* Lam. by Standley and Steyermark (Fieldiana Bot. 24: 5. 1946). When more ample material is collected, it is probable that *C. petenensis* will be recognized as distinct, and its reduction is ill advised at present. The pistillate flowers and fruits borne in cymes, and the short pedicels appear to distinguish the Guatemalan tree. The relationship of *C. petenensis* is nearer *C. Swartzii* Planch. than *C. trinervia* Lam.

Trema laxiflora Lundell, sp. nov.

Arbor parva, ramis minute puberulis; folia petiolata, petiolo 8–20 mm. longo; lamina chartacea, integra, sericea, lanceolato-elliptica vel ovato-

lanceolata, 8–13 cm. longa, 2.8–5 cm. lata, apice caudato-acuminata, basi 3-nervia, rotundata et acuta; cymae ad 4 cm. longae, laxiflorae; fructus ovoideus, 3 mm. longus.

A tree, 20 cm. in diam., 13 m. high; branchlets very minutely puberulent, at first sericeous. Leaves petiolate, the petioles canaliculate, slender, finely sericeous, 8 to 20 mm. long; leaf blades chartaceous, paler beneath, entire, finely sericeous, sparsely so above, lanceolate-elliptic or ovate-lanceolate, 8 to 13 cm. long, 2.8 to 5 cm. wide, apex caudate-acuminate, base 3-nerved, inaequilateral, rounded and acutish. Cymes axillary, slender, up to 4 cm. long, finely sericeous. Perianth of staminate flowers induplicate-valvate, the segments about 1.5 mm. long, ciliate. Stamens glabrous. Torus pilose. Staminate flowers sessile, pistillate flowers borne on slender pedicels up to 5 mm. long, the pedicels jointed at apex. Pistillate perianth persistent at base of fruits, the segments about 1 mm. long, ciliate. Ovary glabrous, style small, bifid to base. Immature drupes ovoid, 3 mm. long.

GUATEMALA: Department of Peten, San Luis-Poptun Road, in secondary forest, July 9, 1959, *C. L. Lundell 16260* (type, LL), a small tree, flowers green; San Luis, km. 56 of road, July 10, 1959, *Lundell 16311* (LL), tree, 8 in. diam., 40 ft. high, flowers greenish.

Its entire sericeous leaves and comparatively large laxly flowered cymes set this species apart. Its relationship to *Trema integerrima* (Beurl.) Standl. remains to be determined. The other species of *Trema* in northern Central America, *T. micrantha* (L.) Blume, *T. floridana* Britton ex Small, and *T. strigillosa* Lundell, have serrate leaves.

T. strigillosa Lundell was reduced to varietal status, *T. micrantha* var. *strigillosa* (Lundell) Standl. & Steyerm. (Field Mus. Bot. 23: 40. 1944), but this disposition of the species is without justification.

ANNONACEAE F90

Annona reticulata L. var. **primigenia** (Standl. & Steyerm.) Lundell, comb. nov.

Annona primigenia Standl. & Steyerm., Field Mus. Bot. 23: 7. 1943.

GUATEMALA: Department of Peten, Gavilan, Fallabon-Yaxha Road, March, 1933, *C. L. Lundell 2213* (type, F; isotype, MICH); Tikal, common in *ramonal* covering the ruins, Feb. 10, 1959, *Lundell 15470* (LL), small tree, 3 in. diam., 25 ft. tall, "*anonillo*"; Tikal, in forest around Aguada Corriental, Feb. 12, 1959, *Lundell 15496* (LL); Tikal, on Remate Road, in *ramonal*, July 3, 1959, *Lundell 16127* (LL), flowers greenish; Tikal National Park, in *ramonal*, Aug. 10, 1959, *Elias Contreras 64* (LL); Oct. 17, 1959, *Contreras 288* (LL); Nov. 25, 1959, *Contreras 422* (LL), "*anonillo*".

This small tree of the upland forest of Campeche, British Honduras, and Peten probably is the progenitor of the widely planted *custard apple* of tropical America and Asia. Its small dry fruits have very little pulp, but they are eaten by the Maya when ripe. Recognition of the wild form is

certainly desirable to call attention to its existence, but only varietal status can be justified. In addition to differences in the fruits, the wild variety is less pubescent than typical *A. reticulata*, but very similar otherwise in other characters.

LAURACEAE

Ocotea mayana (Lundell), comb. nov.

Phoebe mayana Lundell, Am. Midl. Nat. 29: 473. 1943.

BRITISH HONDURAS: Stann Creek District, Baboon Ridge, Stann Creek Valley, in high ridge on top of hill, Feb. 2, 1940, *Percy H. Gentle 3187* (isotype, LL), tree, 12 in. diam., "*timber sweet*". Toledo District, between Monkey River and Cockscomb, in high ridge, Oct. 18, 1942, *Gentle 4212* (LL), tree, 12 in. diam., flowers yellowish, fragrant.

Described from fruiting material, the generic position of the tree has been uncertain. The 1942 Gentle collection with ample flowering material now makes possible the reference of the species to *Ocotea*. Its anther cells arranged in two planes, one above the other, the absence of staminodia, and perianth lobes not reflexed at anthesis are typical of this genus.

The tree has been reported from Guatemala (Fieldiana Bot. 24: 341. 1946) on the basis of *Julian A. Steyermark 44649* from Alta Verapaz.

RUTACEAE

Amyris filipes Lundell, sp. nov.

Frutex, 2-metralis, omnino glabra; folia alterna, unifoliolata, petiolata, petiolo 5–12 mm. longo; lamina membranacea, elliptica, ovato-elliptica vel lanceolata, 6–9 cm. longa, 2.7–5.5 cm. lata, apice acuminata, basi rotundata, subintegra; inflorescentiae cymoso-paniculatae, laxiflorae; flores minuti, tetrameri; calyx persistens, laciniis ovato-triangularibus; petala oblongo-elliptica, ca. 2 mm. longa, 1 mm. lata; ovarium glabrum, uniloculare.

Arborescent shrub, 2 m. high, entirely glabrous. Leaves alternate, unifoliolate, petiolate, the petioles including petiolules, 5 to 12 mm. long; leaflets membranaceous, elliptic, ovate-elliptic or lanceolate, 6 to 9 cm. long, 2.7 to 5.5 cm. wide, apex acuminate, base rounded, margin obscurely crenulate, essentially entire, veinlets conspicuous. Inflorescence terminal and lateral in the axils of the upper leaves, glabrous, divaricately cymose-paniculate, the branches filiform, white, many-flowered, the flowers white. Pedicels 1.5 to 3 mm. long at anthesis, accrescent. Calyx 4-lobed, the lobes ovate-triangular, about 0.5 mm. long. Petals 4, oblong-elliptic, about 2 mm. long, 1 mm. wide. Stamens 8, in two series, the shorter opposite the petals. Disk large. Ovary ovoid, glabrous, the style conspicuous, about a third the length of ovary, the stigma capitate, conspicuous.

GUATEMALA: Department of Peten, San Luis, km. 50 of road, hill above Rio Quebrada Seca, in rain forest, July 11, 1959, *C. L. Lundell 16379* (type, LL), slender arborescent shrub, 6 ft. high.

A. ignea Steyerm. (*A. simplicifolia* Karst. non Roxb.) is nearest *A. filipes*, but differs in its much longer petioles, elliptic or ovate-elliptic coriaceous leaflets, and in the nature of the inflorescence. The divaricately cymose-paniculate inflorescence of *A. filipes* with its long slender branches and pedicels is distinctive.

Amyris vestita Lundell, sp. nov.

Frutex vel arbor parva, ramulis pubescentibus; folia opposita vel subopposita; foliola 3, raro 5, ovato-elliptica, ovato-lanceolata vel lanceolata, 4–8.5 cm. longa, 2–3.8 cm. lata, acuminata, basi late cuneata, obscure crenulata; inflorescentiae cymoso-paniculatae; pedicelli 1.5–2 mm. longi; flores tetrameri; petala glabra, oblongo-elliptica vel oblanceolato-elliptica, ad 3.2 mm. longa, 1.7 mm. lata; ovarium pilosum.

Arborescent shrub, twigs, inflorescence, and petioles finely pubescent. Leaves opposite or subopposite; leaflets 3, sometimes 5, petioluled, the petiolules of lateral leaflets 2.5 to 4 mm. long, leaflets ovate-elliptic, ovate-lanceolate or lanceolate, 4 to 8.5 cm. long, 2 to 3.8 cm. wide, acuminate, the acumen obtuse to acute, base broadly cuneate, acute to obtuse, rather firm, obscurely crenulate, essentially entire. Inflorescence terminal, or lateral in the axils of the upper leaves, cymose-paniculate, usually less than 10 cm. long. Pedicels 1.5 to 2 mm. long at anthesis. Flowers 4-merous, the calyx pubescent, the lobes ovate-triangular, about 0.5 mm. long. Petals gland-dotted, glabrous, oblong-elliptic or oblanceolate-elliptic, up to 3.2 mm. long, 1.7 mm. wide. Stamens 8, in two series, subequal, the shorter opposite the petals. Disk orange-red, well developed. Ovary pilose, ellipsoid, gland-dotted, stigma large, capitate.

GUATEMALA: Department of Peten, Tikal, on top of Temple V, February 7, 1959, *C. L. Lundell 15395* (type, LL).

It is probably foolhardy to propose another segregate from the *A. elemifera* L. complex, but *A. vestita* differs notably in having a pilose ovary. In this respect it is similar to *A. balsamifera* L.

MELIACEAE

TRICHILIA ERYTHROCARPA Lundell, Bull. Torrey Club 64: 551. 1937.

GUATEMALA: Department of Peten, Tikal, on Remate Road, in *zapotal*, February 13, 1959, *Lundell 15541* (LL), tree, fruits red; same locality, July 3, 1959, *Lundell 16135* (LL), tree, 6 in. diam., 30 ft. high, flowers tawny-yellow, leaves tawny beneath. BRITISH HONDURAS: El Cayo District, Cohune Ridge, July 13, 1936, *Lundell 6495* (isotype, LL); Valentin, *Lundell 6319* (LL), *6364* (LL).

The flowers, heretofore known only from specimens in bud, are borne on pedicels 1 to 2.5 mm. long, jointed above the base. The lanceolate-oblong petals are reflexed at anthesis, 3 to 4 mm. long, apiculate.

The species is uncommon in the Tikal National Park where it grows in the *zapotal*.

TRICHILIA YUCATANENSIS Lundell, Bull. Torrey Club 69: 392–393. 1942.

GUATEMALA: Department of Peten, Uaxactun, April 27, 1931, *H. H. Bartlett* 12775 (LL), tree, 9 in. diam., smooth dark gray bark; Tikal, in *ramonal*, Feb. 10, 1959, *Lundell 15469* (LL), tree, 10 in. diam., 60 ft. high, flowers greenish-white, "*chili chachalaca*"; same locality, Feb. 12, 1959, *Lundell 15507, 15510* (LL), tree, 4 in. diam., 35 ft. high, flowers greenish; Tikal, in *zapotal* between airfield and Aguada Seca, Feb. 19, 1959, *Lundell 15644* (LL), tree, 10 in. diam., 60 ft. high; Tikal, in *ramonal*, July 4, 1959, *Lundell 16174* (LL), tree, 6 in. diam., 45 ft. high, "*cedrillo*". MEXICO: Campeche, Monterrey, Jan. 23, 1932, *Lundell 1240* (LL).

T. yucatanensis and *T. Matudai* Lundell (Lloydia 2: 94–96, *pl. 5*. 1939) are both allied to *T. moschata* Sw. as pointed out when these species were described.

In the material from Tikal, the first adequate collections of *T. yucatanensis* available, the inflorescences range up to 18 cm. long, and the capsules are ellipsoid, up to 2 cm. long.

Standley and Steyermark (Fieldiana Bot. 24: 466. 1946) list *T. yucatanensis* as a synonym of *T. montana* H. B. K. Apparently this was done without examining either the type or the original description, for *T. yucatanensis* does not remotely resemble *T. montana*, and the two are not closely related. At least interment in the family plot would be in order!

Other species collected at Tikal are *T. havanensis* Jacq. (*Bartlett 12625*), *T. minutiflora* Standl. (*Lundell 15272, 15483*), and *T. montana* H. B. K. (*Lundell 15298, 15493, 15825*).

T. yucatanensis and *T. minutiflora* are among the dominant tree elements in the *ramonal* and *zapotal*.

EUPHORBIACEAE

Sebastiania tikalana Lundell, sp. nov.

Arbor parva 5-metralis, omnino glabra; folia chartacea, lanceolata, 5.5–12.5 cm. longa, 3–4.5 cm. lata, apice acuminata, basi rotundata, serrulata; petiolus 1–2 cm. longus, gracilis, glandulosus; spicae terminales; capsula ovoidea, 8–10 mm. longa; semina ovoidea, ca. 5 mm. longa.

Tree 5 m. high, 7.5 cm. in diam., entirely glabrous, twigs thick. Leaves chartaceous, lanceolate, 5.5 to 12.5 cm. long, 3 to 4.5 cm. wide, apex acuminate, base rounded, margin serrulate, the lateral nerves 12 to 16 pairs; petioles slender, 1 to 2 cm. long, bearing 1 to 3 sessile saucer shaped glands at apex. Fruits 1 to 3, terminal, the fruit bearing spikes thick, up to 2 cm. long. Capsules smooth, ovoid, 8 to 10 mm. long, shallowly sulcate, apiculate. Seeds ovoid, about 5 mm. long, the testa hard.

GUATEMALA: Department of Peten, Tikal, in low forest on top of Temple III, October 27, 1959, *Elias Contreras 322* (type, LL), laticiferous.

In its large lanceolate leaves rounded at base and saucer-shaped sessile glands at apex of petioles, *S. tikalana* is unlike any other member of the genus in Mexico and Central America. The large capsules and ovoid seeds are distinctive.

FLACOURTIACEAE

Bartholomaea paniculata Lundell, sp. nov.

Arbor parva, 4 m. alta, ramulis puberulis; folia chartacea, breviter petiolata, petiolo 3–8 mm. longo; lamina 3-nervia, crenata, ovato-lanceolata vel lanceolata, 4–7 cm. longa, 1.5–3 cm. lata, basi barbata, rotundata, apice acuminata; inflorescentiae spicatae vel paniculatae, minute puberulae; capsula depresso-globosa, glabra, 3–4 mm. diam.; semina longe pilosa.

Slender arborescent shrub, 4 m. high; branches slender, at first minutely puberulent, the hairs subappressed, glabrate early. Leaves chartaceous, petiolate; the petioles minutely puberulent with subappressed hairs, glabrate early, 3 to 8 mm. long; leaf blades dull, slightly paler beneath, ovate-lanceolate or lanceolate, 4 to 7 cm. long, 1.5 to 3 cm. wide, trinerved, barbate beneath at base in nerve axils, glabrous otherwise except for a few appressed hairs along the costa beneath, base usually rounded, sometimes acutish, inaequilateral, apex short acuminate, the acumen obtuse to obtusish, margin inconspicuously crenate. Inflorescences subappressed-puberulent, filiform, reflexed, the axillary solitary and spicate, the terminal paniculate with two or more spicate branches; the staminate inflorescenses up to 12 cm. long, staminate flowers sessile, subtended by three minute puberulent bractlets, the outer acuminate, the sepals usually 4, rarely 5, suborbicular, glabrous, the petals glabrous, stamens 8 or 10, borne on a pilose receptacle, the filaments glabrous; the pistillate inflorescences shorter than staminate, 3.5 to 6 cm. long, pistillate flowers sessile, subtended by three minute puberulent bractlets, sepals usually 4, rarely 5, spatulate, rounded and minutely erose, the flattened calyx about 2 mm. in diameter, glabrous; ovary glabrous, 4-celled, the style short, the stigma 4-branched to form a distinct cross. Capsules depressed globose, glabrous, 3 to 4 mm. in diameter, seeds covered with long white cottony fibers.

GUATEMALA: Department of Peten, Tikal, on top of Temple V, Feb. 7, 1959, *C. L. Lundell 15383* (type, LL), slender shrub, 12 ft. high (pistillate plant); same locality and date, *Lundell 15394* (LL), arborescent shrub (staminate plant).

From the other two species in this endemic genus, *B. mollis* Standl. & Steyerm. and *B. sessiliflora* (Standl.) Standl. & Steyerm., which I know only from description, *B. paniculata* differs in having 3-nerved leaves barbate at base beneath but otherwise glabrous; in its inflorescences which are axillary and terminal, the terminal being paniculate; in its comparatively large capsules; and, 4- rarely 5-merous flowers.

Samyda Bartlettii (Lundell), comb. nov.

Casearia Bartlettii Lundell, Lloydia 2: 104. 1939.

GUATEMALA: Department of Peten, Uaxactun, April 10, 1931, *H. H. Bartlett 12558* (isotype, LL), "*xililche*"; Tikal, in *ramonal* on Uaxactun trail, April 13, 1959, *Lundell 15883* (LL), tree, 10 in. diam., 33 ft. high, flowers white; same locality, May 16, 1959, *Lundell 15994* (LL), tree, 6 in. diam., 25 ft. high, flowers white; Tikal, in *ramonal* on Remate Road, June 12, 1959, *Lundell 16072* (LL), tree, 10 in. diam., 40 ft. high; same locality, in *zapotal*, July 3, 1959, *Lundell 16139* (LL), tree, 5 in. diam., 20 ft. high, fruits ellipsoid, smooth and fleshy, up to 6 cm. long, three celled, bright red within, the aril orange. MEXICO: Tabasco, Retiro, near Tenosique, in virgin forest, June 19–25, 1939, *Eizi Matuda 3470* (LL), tree.

The presence of staminodes alternating with the stamens in *S. Bartlettii* suggests *Casearia*, but the large white flowers with the staminal tube 6 to 7 mm. long are more typical of *Samyda*. In *Samyda yucatanensis* Standl., rudimentary staminodes are present.

S. Bartlettii is one of the common trees in both the *ramonal* and *zapotal* at Tikal.

MYRTACEAE

Eugenia Ibarrae Lundell, sp. nov.

Arbor parva, glabra, ramulis gracilibus; folia petiolata, petiolo crasso, 2–3.5 mm. longo, lamina subcoriacea, late elliptica, obovato-elliptica vel oblongo-elliptica, 3–6.5 cm. longa, 1.3–3.5 cm. lata, apice late obtusa, basi cuneata, trinervia; flores sessiles in axillis foliorum fasciculati; sepala ciliolata, inaequalia, usque ad 2 mm. longa; petala alba, ciliolata, suborbicularia, 3.2–4 mm. longa; stylus 5–5.5 mm. longus.

Slender tree, about 3 m. high, 3 cm. in diam., entirely glabrous, twigs slender, slightly compressed at the nodes. Petioles short, thick, 2 to 3.5 mm. long, canaliculate. Leaf blades subcoriaceous, paler beneath, broadly elliptic, obovate-elliptic or oblong-elliptic, 3 to 6.5 cm. long, 1.3 to 4 cm. wide, usually 3 to 3.5 cm. wide, apex broadly obtuse, base cuneate and decurrent on the petiole, the veins conspicuous on both surfaces, trinerved at base. Flowers axillary, fasciculate, sessile or nearly so, hypanthium shorter than calyx. Sepals 4, unequal, broadly ovate-orbicular, rounded at apex, ciliolate, the larger pair scarcely 2 mm. long, the smaller pair 1 to 1.3 mm. long. Petals white, ciliolate, pellucid-punctate, suborbicular, slightly longer than wide, 3.2 to 4 mm. long. Stamens numerous, subequaling style. Style 5 to 5.5 mm. long. Ovary 2-celled, with several ovules in each cell.

GUATEMALA: Department of Peten, Bajo de Santa Fe, on *pinal* trail, in *tintal*, July 24, 1959, *Elias Contreras 19* (type, LL), flowers white, "*chilonche*".

The leaves resemble those of *E. mayana* Standl. superficially, but that tree has much smaller flowers, and all parts are puberulent. *E. Lundellii*, which grows with *E. Ibarrae*, has similar discolorous leaves with altogether different venation, as well as having pubescent flowers and young growth.

I take pleasure in naming this tree for Mr. Jorge Ibarra, founder and able director of the Museo Nacional de Historia Natural of Guatemala. Mr. Ibarra has secured all government permits and handled the shipments of plant collections from Peten from month to month. Also, he has assisted personally in many ways to expedite the program. For his help I am deeply grateful.

EUGENIA LUNDELLII Standl., Carnegie Inst. Publ. 461: 76. 1935.

GUATEMALA: Department of Peten, Tikal National Park, Bajo del Hormiguero, on old Remate Road, in *tintal*, Feb. 13, 1959, *C. L. Lundell 15518* (LL), *15527* (LL), slender tree, 2 in. diam., 15 to 20 ft. high, with tan scaling bark, "*guayabillo*"; Tikal, Bajo de Santa Fe, in *tintal* on Aguada Terminos Road, Feb. 16, 1959, *Lundell 15574* (LL); same locality, May 9, 1959, *Lundell 15975* (LL), flowers white; same locality, July 17, 1959, *Lundell 16489* (LL); Bajo de Santa Fe, on *pinal* trail, July 24, 1959, *Elias Contreras 26* (LL), tree, 3 in. diam., 30 ft. high, "*guayabillo*". MEXICO: Campeche, Chan Laguna, Dec. 6, 1931, *Lundell 1016* (LL).

In Bajo de Sante Fe and Bajo del Hormiguero of the Tikal National Park, this slender gnarled tree with its tan scaling bark is a characteristic element. Although the most evident *Eugenia* in swamp forest of the peninsula, the species has been collected sparingly heretofore. No flowering material was available at the time it was described.

The flowers (*Lundell 15975*) usually are fasciculate in the leaf axils, but often they are borne on short racemes on the same twig. The racemes are short, usually only 1 or 2 mm. long, but sometimes up to 5 mm. long. The pedicels of the flowers range from 1.5 to 7 mm. long; they are accrescent, and range up to 10 mm. long in fruit. The hypanthium is fully 1 mm. long; the 4 sepals are subequal, oval, the larger pair about 1.5 mm. long, the smaller pair about 1 mm. long. The white petals are suborbicular, sparsely glandular punctate, 2.5 to 3 mm. long. The stamens are numerous, up to 4 mm. long, and the style is curved, about 5 mm. long. The ovary is 2-celled, with several ovules in each cell.

As described by Standley (l.c.) the reddish sericeous indument is conspicuous on the very young undeveloped leaves and new growth, and persistent on the inflorescence and flowers. Mature twigs are puberulent at first, but glabrate in time. Although the coriaceous mature glabrous leaves usually are small, they sometimes reach a width of 4 cm. and a length of 7.5 cm. The discolorous leaf characteristic is one of the distinguishing marks of the species.

The fasciculate and racemose inflorescences on the same twig of *E. Lundellii*, and the accrescent pedicels, are noteworthy, indicating that our interpretation of species in the genus must take into account such variables. Repeated collections of even the common species of *Eugenia* are needed in all stages of flower and fruit development.

EUGENIA OVATIFOLIA Lundell, Bull. Torrey Club 69: 396. 1942.

GUATEMALA: Department of Peten, Tikal, Bajo de Santa Fe, in *tintal* on Aguada Terminos trail, July 17, 1959, *C. L. Lundell 16505* (LL), slender shrub, 6 ft. high, flowers white.

The Tikal shrub is glabrous except for the hairy bracts of the inflorescence, and ciliolate sepals and petals. In leaf and flower characters it agrees closely with the typical form of *E. ovatifolia* from British Honduras, but differs in not being pubescent.

Another collection from the *ramonal* at Tikal, *Lundell 15932*, may be referable here.

EUGENIA WINZERLINGII Standl., Trop. Woods 11: 20. 1927.

GUATEMALA: Department of Peten, Bajo del Hormiguero, in *tintal* on old Remate Road, Feb. 13, 1959, *C. L. Lundell 15534* (LL), tree, 3 in. diam., 20 ft. high; Tikal, Bajo de Santa Fe, in *tintal* on trail between Aguada Terminos and Aguada La Aurora, Feb. 17, 1959, *Lundell 15614* (LL); same locality, Feb. 20, 1959, *Lundell 15693* (LL), tree, 6 in. diam., 32 ft. high; Tikal, Bajo de Santa Fe, in *tintal* on trail to Aguada Terminos, Feb. 21, 1959, *Lundell 15703* (LL); same locality, April 21, 1959, *Lundell 15900* (LL), ripe fruits purplish, depressed globose, up to 1 cm. diam.

E. Winzerlingii, one of the larger conspicuous trees of the *tintal* of Bajo de Santa Fe at Tikal, is characterized by rough bark. The distinctive thick coriaceous leaves range up to 12 cm. long, and 7 cm. wide, although usually smaller. Flowers of the species have not been collected at anthesis, but a collection from which the petals and stamens have fallen (*Lundell 15534*) has pedicels 1.5 to 6 mm. long. In a later stage of flower development *Lundell 15693*, pedicels are slender, 1.5 to 2.5 cm. long. An intermediate is represented by *Lundell 15900*, a mature fruiting specimen with pedicels up to 1 cm. long, but averaging less. As in *E. Lundellii*, the pedicels are accrescent and variable in length.

E. Winzerlingii was described from British Honduras, where it grows in the pine ridges.

Pimenta Tabasco (Schlecht. & Cham.) Lundell, comb. nov.

Myrtus Tabasco Schlecht. & Cham., Linnaea 5: 559. 1830.

GUATEMALA: Department of Peten, Tikal, in *ramonal* covering the ruins, March 4, 1959, *C. L. Lundell 15823* (LL), tree with light tan scaling bark, 18 in.

diam., 40 ft. high, "*pimienta gorda*"; Tikal, in *zapotal* on trail to Aguada Naranjal, July 4, 1959, *Lundell 16159*, tree, 12 in. diam., 60 ft. high.

The *pimienta gorda* grows in abundance in the *ramonal* at Tikal. Its light tan scaling bark makes the tree stand out conspicuously in otherwise somber surroundings. The commercial allspice of Jamaica, *Pimenta dioica* (L.) Merr. (*Pimenta officinalis* Lindl.), has much smaller fruits than the Central American tree.

Again we have another species of economic importance to the Maya, apparently surviving as a relict among the ruins.

MYRSINACEAE

ARDISIA BELIZENSIS Lundell, Contr. Univ. Mich. Herb. 7: 38–39. 1942.

GUATEMALA: Department of Peten, in forest bordering Aguada Bejucal, Feb. 11, 1959, *Lundell 15474* (LL), arborescent shrub; around Aguada Corriental on Arroyo Corriental, Feb. 12, 1959, *Lundell 15489* (LL), arborescent shrub or small tree.

Described from British Honduras, *Percy H. Gentle 3158* (LL), *3500* (isotype, LL), this species is infrequent at Tikal.

Ardisia erythrocarpa Lundell, sp. nov.

Frutex, ramis minute puberulis vel glabratis; folia petiolata, petiolo 3–8 mm. longo; lamina membranacea, lanceolato-elliptica, elliptica vel oblanceolata, 3–10 cm. longa, 1.3–4.3 cm. lata, basi acuta, apice acuminata, crenulata vel subintegra; inflorescentiae subcorymbosae, 3–8-florae; pedicelli 8–15 mm. longi; sepala ciliata, punctata, ca. 2 mm. longa; fructus globosus, 6–8 mm. diam.

Slender shrub, about 2 m. high, branchlets slender, very minutely and rather sparsely puberulent with red hairs, glabrate. Leaves petiolate, the petioles minutely puberulent, 3 to 8 mm. long, the acute base of blade decurrent on petiole. Leaf blades membranaceous, lanceolate-elliptic, elliptic or oblanceolate, 3 to 10 cm. long, 1.3 to 4.3 cm. wide, apex acuminate, the acumen obtusish, margin crenulate above or subentire, glabrous except for minute scattered hairs above. Inflorescence subcorymbose, terminal, minutely puberulent, 3- to 8-flowered, rarely reduced to 1 flower. Pedicels slender, 8 to 15 mm. long, slightly enlarged above. Calyx 5-merous, minutely red-puberulent, the sepals ciliate, punctate, ovate-lanceolate, about 2 mm. long subtending fruit. The fruits bright red, depressed globose, 6 to 8 mm. in diam.

GUATEMALA: Department of Peten, San Luis, km. 52 of road south of village, on forest floor in dense shade, July 10, 1959, *C. L. Lundell 16267* (type, LL), arborescent shrub, 6 ft. high, fruits depressed globose, bright red; same locality, July 12, 1959, *Lundell 16382* (LL), slender shrub, 6 ft. high, fruits depressed globose or ovoid, dark red.

In the section Icacorea, the species with crenulate leaves and subcorymbose terminal inflorescences, which include *A. nigrescens* Oerst., *A. Donnell-Smithii* Mez, *A. Mitchellae* Johnston, *A. Carlsonae* Steyermark, and *A. erythrocarpa*, are very closely related. In its indumentum consisting of very minute rather sparse reddish hairs, few-flowered inflorescences, pedicels usually less than 12 mm. long, ciliate sepals 2 mm. long, and rather large fruits, *A. erythrocarpa* appears to be distinct.

ARDISIA PASCHALIS Donn. Smith, Bot. Gaz. 19: 5. 1894.

GUATEMALA: Department of Peten, Tikal, in *ramonal*, Feb. 4, 1959, *Lundell 15320* (LL), small tree, 2 in. diam., 14 ft. high, inflorescence yellowish, ripe fruits purple-black; same locality, April 27, 1959, *Lundell 15921* (LL), small tree, 2 in. diam., 17 ft. high, flowers white and pink, "*xilil*".

A. paschalis is one of the characteristic small trees in the *ramonal*.

RAPANEA GUIANENSIS Aubl., Pl. Guian. 121, *pl. 46*. 1775.

GUATEMALA: Department of Peten, Bajo de Santa Fe, in *tintal* on Aguada Terminos Road, Feb. 21, 1959, *Lundell 15702* (LL), tree, 5 in. diam., 16 ft. high.

Although common in swamp forest at Tikal, the species has not been reported previously from the area.

THEOPHRASTACEAE

DEHERAINIA SMARAGDINA (Planch.) Decne., Ann. Sc. Nat. VI. 3: 139, *pl. 12*. 1876.

GUATEMALA: Department of Peten, at Santa Cruz near Yaxha, in *zapotal*, March 23, 1933, *Lundell 2199* (MICH), tree, 7 m. high; San Luis, km. 50 of road, in high rain forest on hillside, July 11, 1959, *Lundell 16377* (LL), slender shrub, 3 ft. high, growing on forest floor, the fruits oblong-ellipsoid, up to 9 cm. long, apex attenuate, the seeds white and translucent.

Jacquinia albiflora Lundell, sp. nov.

Arbor parva; ramuli dense minutissime puberuli; folia petiolis ad 2 mm. longis stipitata, elliptico-lanceolata vel oblongo-lanceolata, 2.5–5 cm. longa, 1–1.5 cm. lata, apice acutiuscula, spinuloso-apiculata; inflorescentiae racemosae, 5–7-florae, ad 3 cm. longae, pedicellis 6–7 mm. longis; sepala ca. 3 mm. longa; corolla alba, 7 mm. longa, petalis ad 3/7 in tubum coalitis; staminodia late elliptica, ad 2.7 mm. longa, 2.3 mm. lata. Fructus globosus, 1.5–2 cm. diam., apice stylo mucronatus.

A small tree, 12.5 cm. in diameter. Branches sulcate, yellowish, resinous, minutely but densely puberulent. Leaves coriaceous, puncticulate, puberulent above along costa, otherwise glabrous, elliptic-lanceolate or oblong-lanceolate, 2.5 to 5 cm. long, 1 to 1.5 cm. wide, apex usually acute, sometimes rounded, spinescent, the spine rigid, 1 to 1.3 mm. long, base acute,

the petiole up to 2 mm. long, puberulent. Inflorescence up to 3 cm. long, racemose, 5- to 7-flowered, sparsely puberulent or glabrate, the peduncles up to 1 cm. long, pedicels 6 to 7 mm. long, the bractlet about 1 mm. from base, ovate, minutely ciliate. Sepals glabrous, rounded, ca. 3 mm. long, the margin hyaline, minutely erose. Corolla white, 7 mm. long; petals united into a tube 3 mm. long, the petals broadly elliptic, slightly longer than wide, entire, rounded at apex, auriculate at base. Staminodia petal-like, broadly elliptic, up to 2.7 mm. long, 2.3 mm. wide, cordate at base. Filaments free about 1 mm. above base of corolla tube, 2 mm. long. Anthers about 1.7 mm. long, the protruding connective obtuse and minutely emarginate at apex. Ovary 3.5 mm. long (including style and stigma). Fruits globose, 1.5 to 2 cm. in diam., apiculate.

GUATEMALA: Department of Peten, Tikal, in low forest on top of Temple III, July 29, 1959, *Elias Contreras 45* (type, LL), *"tzic"*.

The relationship of *J. albiflora* is with *J. Donnell-Smithii* Mez, but *J. albiflora* differs in its puberulent branches, shorter spine at apex of leaf, and petals united into a tube at base only. The color of the corollas of *J. Donnell-Smithii* is not indicated.

No less than four species of *Jacquinia* are growing at Tikal. Useful plants are spared by the Maya when land is cleared, and the presence of this number of species, some of which may have been introduced in ancient times, may be accounted for by this practice. They grow principally on the higher temples, around the *aguadas* (water holes), and in the *bajos* (swamps).

The stiff corollas, both the brilliant orange-red and white, are strung on cords and used by the Maya as necklaces, or for other ornamental purposes. They retain their color, and were employed in ancient times for decorating the Maya temples.

Jacquinia leptopoda Lundell, sp. nov.

Arbor parva; ramuli minutissime puberuli; folia petiolis ad 3 mm. longis stipitata, lanceolata vel oblanceolata, 3–7.5 cm. longa, 1–2.4 cm. lata, apice attenuata et spinuloso-apiculata, basi attenuata; inflorescentiae racemosae, 3–7-florae, 5–7 cm. longae; pedicellis rigidis, ad 16 mm. longis; sepala 4–4.5 mm. longa; corolla aurantiaca, 11–13 mm. longa, petalis ultra medium in tubum coalitis; staminodia oblongo-elliptica, 3–3.5 mm. longa; ovarium stylo manifesto, subaequilongo.

Tree, 10 cm. in diam., about 7 m. high; branches very minutely puberulent, sulcate. Leaves lanceolate or sometimes oblanceolate, 3 to 7.5 cm. long, 1 to 2.4 cm. wide, apex usually attenuate and spinescent, the spine 1.5 to 2 mm. long, base attenuate into a short thick petiole 1.5 to 3 mm. long, the petiole puberulent. Inflorescence racemose, sparingly puberulent, 5 to 7 cm. long, 3- to 7-flowered; pedicels straight, up to 16 mm. long, with a ciliate bractlet near the base. Sepals orbicular, 4 to 4.5 mm. long, entire, the margin hyaline, sparingly lepidote within. Corolla bright orange, 11

to 13 mm. long, petals united into a tube 6 to 7 mm. long, the lobes suborbicular, 5 to 6 mm. long. Staminodia oblong-elliptic, 3 to 3.5 mm. long. Filaments free 2 mm. above base of corolla tube, lepidote at base and apex. Anthers about 3 mm. long, apex emarginate. Ovary subequaling style.

GUATEMALA: Department of Peten, Tikal, around Aguada Bejucal, May 16, 1959, *C. L. Lundell 15997* (type, LL).

The closely allied species, *J. axillaris* Oerst., *J. racemosa* A. DC., *J. cuneata* Standl., *J. panamensis* Lundell and *J. leptopoda* can be distinguished from each other only by degrees, involving leaf shape, length of spine at apex of leaf, length of pedicel, size of corolla, length of corolla tube, size of staminodia, and prominence of style.

It is with some misgivings that I describe *J. leptopoda*. Its leaf characteristics, large flowers, petals united above the middle, and smaller staminodia, appear to set it apart. In *J. cuneata*, described from Campeche, the leaves are obovate, with the spinescent apex usually rounded or obtuse.

JACQUINIA PALUDICOLA Standl., Field Mus. Bot. 11: 138. 1932.

GUATEMALA: Department of Peten, San Luis, Rio Quebrada Seca, along shaded bank of stream bed, July 11, 1959, *Lundell 16364* (LL), slender shrub, 3 to 10 ft. high, corolla creamy-yellow. BRITISH HONDURAS: Toledo District, Bolo Camp, upper reach of Golden Stream, in high ridge, April 17, 1944, *Percy H. Gentle 4546* (LL), small tree; same locality, Apr. 18, 1944, *Gentle 4549* (LL), tree, 3 in. diam., "*bastard lime*"; upper reach of Golden Stream, in cohune ridge, May 2, 1944, *Gentle 4567* (LL), tree, 2 in. diam. flowers yellow, scented, "*bastard lime*".

In the collections cited, the branches and petioles are minutely puberulent, not glabrous as stated by Standley (l.c.) in the original description. In *Gentle 4549*, the leaves are broadly elliptic, up to 5.5 cm. wide, the fruits globose, up to 1.5 cm. in diameter.

SCROPHULARIACEAE

Russelia campechiana Standl. var. **lilacina** Lundell, var. nov.

Frutex scandens, caule ad 4 cm. diam.; corolla ad 17 mm. longa, lilacina.

GUATEMALA: Department of Peten, Tikal, on top of Temple IV, Feb. 6, 1959, *C. L. Lundell 15363* (type, LL).

The variety is more robust, and differs in having lilac colored flowers, and corollas up to 17 mm. long. In the species the corollas are bright red and somewhat smaller.

This remarkable plant, growing on the top of Temple IV, is worthy of introduction into tropical gardens. The ends of the branches bear large crowded axillary inflorescences which form exceptionally attractive sprays of lilac colored flowers.

R. campechiana var. *lilacina* appears to be an horticultural relict which has survived the millennium since the ancient Maya abandoned Tikal.

RUSSELIA SARMENTOSA Jacquin emend. Carlson, Fieldiana Bot. 29: 259–267. 1957.

In her monograph of the genus, Carlson (l.c.) "concluded that *R. sarmentosa* is a variable and widely distributed species, ranging from Cuba, Tabasco and Yucatan, Mexico, to Panama and Colombia". She stated further that no consistent differences in size of leaves, degree of pubescence, number of flowers on an inflorescence, and length of peduncles could be found, and attempts to separate the plants into species or even into varieties were fruitless. Nevertheless, she described three new forms and two varieties of the species.

Collections which I made in Peten in 1959 revealed the presence, in each population of *R. sarmentosa* examined, of forma *eglandulata* Carlson, forma *pubescens* Carlson, and forma *velutina* Carlson. At Poptun and on the cleared sides of Temple I and Temple III at Tikal, the three occur with all degrees of intergradation present. The eglandular plants appear to outnumber the glandular, and all are pubescent to some degree. Hence even the recognition of forms appears futile in this species.

GUATEMALA: Department of Peten, Tikal, on cleared sides of Temple I, Feb. 5, 1959, *Lundell 15334* (LL), *15335* (LL); Tikal, on Temple III, Feb. 20, 1959, *Lundell 15674* (LL); Poptun, on limestone knoll in pineland on road to Machaquila, July 13, 1959, *Lundell 16404* (LL).

RUBIACEAE

Guettarda tikalana Lundell, sp. nov.

Frutex scandens, ramulis crassis, dense hirsutis; stipulae 6–7 mm. longae; folia opposita, membranacea, obovata vel obovato-elliptica, 8–16 cm. longa, 4–8.5 cm. lata, apice breviter acute acuminata, basi rotundata vel obtusa, subtus fere concolor, dense pilosa; petioli hirsuti, 7–12 mm. longi; cymae pauciflorae; drupa conica, 2.8 cm. longa, 1.5 cm. lata.

Woody vine, branchlets densely brown hirsute. Stipules acuminate, 6 to 7 mm. long, deciduous. Leaves opposite, membranaceous, obovate or obovate-elliptic, 8 to 16 cm. long, 4 to 8.5 cm. wide, apex short acuminate or acute, base narrowed, rounded or obtuse, densely pilose on lower surface, pubescent on upper surface primarily along costa and veins, lateral nerves 8–12 pairs; petioles hirsute, 7 to 12 mm. long. Cymes axillary and terminal, hirsute, at first dense, the branches in fruit as much as 2.5 cm. long. Fruits sessile, finely tomentulose, conic or obovoid-conic, the immature up to 2.8 cm. long, 1.5 cm. in diam. at apex.

GUATEMALA: Department of Peten, Tikal, on Uaxactun trail, in center of *escobal*, July 18, 1959, *C. L. Lundell 16519* (type, LL), woody vine.

The scandent habit, the large thin obovate pilose leaves, and the obovoid-conic fruits well mark the species.

NOTABLE BROMELIACEAE OF THE LUNDELL HERBARIUM

Lyman B. Smith

In a recent loan of North American Bromeliaceae from the Lundell Herbarium, I have found two plants whose new varietal names require publication before they can be annotated. It seems appropriate to make this publication where future students would naturally seek such information.

Subfamily Pitcairnioideae

Pitcairnia Palmeri S. Wats., Proc. Am. Acad. 22: 456. 1887.

Inflorescence lax, few-flowered; floral bracts half as long as all but the lowest pedicels; flowers secund.

Pitcairnia Palmeri var. **longebracteata** L. B. Smith, var. nov.

A var. *Palmeri* bracteis florigeris elongatis, pedicellos aequantibus vel superantibus differt.

Type in the Lundell Herbarium, collected on cliffs in pine-oak forest, 15 to 17 miles northeast of Palmito along highway from Mazatlan to Durango, altitude 2100–2250 meters (7000–7500 feet), June 16, 1951, by H. S. Gentry and C. L. Gilly (No. 10625).

Subfamily Tillandsioideae

Catopsis sessiliflora (R. & P.) Mez in DC., Monogr. Phan. 9: 625. 1896.

Tillandsia sessiliflora R. & P., Fl. Peruv. 3: 42, *pl. 271, fig. b.* 1802.

Scape-bracts all shorter than the internodes; flowers perfect; sepals suborbicular, 7–8 mm. long.

Catopsis sessiliflora var. **dioica** L. B. Smith, var. nov. Fig. 9.

Tillandsia apicroides Schlecht. & Cham., Linnaea 6: 55. 1831.
Tillandsia aloides Schlecht. & Cham., Linnaea 6: 55. 1831.
Catopsis apicroides (Schlecht. & Cham.) Baker, Journ. Bot. 25: 174. 1887.
Catopsis aloides (Schlecht. & Cham.) Baker, Handb. Bromel. 154. 1889.

A var. *sessiliflora* floribus dioicis, eis masculinis valde reductis differt.

Type in the Lundell Herbarium, collected on tree in cohune ridge beyond Columbia, Toledo District, British Honduras, March 3, 1947, by Percy H. Gentle (No. 6186).

As in *Catopsis nutans* (Sw.) Griseb. (cf. N. Am. Flora 19: 193. 1938),

Fig. 9. *Catopsis sessiliflora* var. *dioica* L. B. Smith, var. nov.

the different sexual states of *C. sessiliflora* have been treated as distinct species. It is interesting to note that the dioecious states of *Catopsis* are limited to Mexico and Central America, although the genus as a whole and even the above species are widely distributed in the West Indies and northern South America.

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STUDIES OF PHYSOSTEGIA—II

FURTHER NOTES ON THE TEXAS SPECIES

Cyrus Longworth Lundell

Physostegia intermedia (Nutt.) Engelm. & A. Gray, Bost. Journ. Nat. Hist. 5: 257. 1845.

Dracocephalum intermedium Nutt., Trans. Amer. Phil. Soc. 5: 187. 1837.

TEXAS: Austin County, Wallis, depression in clayey prairie, May 4, 1920, *Francis W. Pennell 10277* (PH), corolla purple. Bowie County, in ditch along highway 59, north of Texarkana, May 24, 1958, *D. S. Correll & C. L. Lundell 18822* (LL), plants stoloniferous, flowers lavender-pink, maculate in throat. Dallas County, Dallas, swamps, June, 1879, *J. Reverchon 777* (US); Dallas, swamps, May, 1880, *Reverchon 777* (US); vicinity of Dallas, damp ground, April 27, 1929, *Mary R. Stephenson 222* (US); off U. S. highway 175, between Elam and Seagoville, May 17, 1941, *C. L. Lundell & Amelia A. Lundell 10637* (LL, US), perennial herb, corolla lavender, maculate; same locality, in marshy area, June 11, 1944, *Lundell & Lundell 12919* (LL), plants erect, aquatic, corolla pinkish-lavender, maculate in throat. Fannin County, off highway 34, 1½ miles north of Ladonia, old bed of North Sulphur River, June 11, 1958, *C. L. Lundell 15114* (LL), aquatic, rhizomatous herb, rhizomes white, slender, internodes elongated, corolla lavender, purple maculate. Franklin County, off U. S. highway 271, in wet bottoms of Sulphur River near Talco, May 29, 1958, *Lundell 15073* (LL), erect herb, corolla lavender, throat purple maculate. Henderson County, off U. S. highway 175, northwest of Athens, in roadside ditch, June 4, 1958, *Lundell 15099* (LL), erect herb, leaves rather remotely denticulate to base, corolla lavender, purple maculate. Orange County, Cow Bayou, 14 miles southwest of Orange, May 15, 1937, *V. L. Cory 22368* (GH). Refugio County, in land periodically flooded, 1 mile southeast of Austwell, April 6, 1959, *Correll 20840* (LL), plants stoloniferous and suckering at base, base of stem swollen and fistulose, flowers pink, spotted in throat. Rockwall County, 2½ miles west of Rockwall, frequent in moist soil of highway borrow ditch, May 10, 1949, *Cory 55812* (US), stems simple, up to 7.5 dm. high. Tarrant County, on borders of Callaway Lake, May 21, 1927, *Albert Ruth 1470* (US). Titus County, off U. S. highway 271, Cypress Creek bottoms, abundant in open woodland, May 29, 1958, *Lundell 15076* (LL), corolla lavender or bluish-lavender, maculate; off highway 49, about 1 mile southeast of Mount Pleasant, in open bottom land of Hart Creek, May 29, 1958, *Lundell 15074* (LL), erect herb, corolla lavender, purple maculate. Waller County, in low marshland near entrance to Stephen F. Austin State Park, near Sealy, May 25, 1957, *D. S. Correll & G. Edwin 16438* (LL). ARKANSAS: Craighead County, Lake City, abundant in water at roadside, June 11, 1928, *Delzie Demaree 5089* (PH, US). Hempstead County, off U. S. highway 67, 9.5 miles northeast of Texarkana, in roadside ditch, June 6, 1959, *Lundell & Lundell 16034* (LL), rhizomatous herb, corolla rose-lavender. LOUISIANA:

Calcasieu Parish, Lake Charles, river banks, May 18, 1915, *E. J. Palmer 8679* (US).

Of the numerous collections of *P. intermedia* from Texas, only a few are cited to give collector's field notes and to indicate the range of the species within the state. It abounds in Arkansas and Louisiana.

The type locality of *P. intermedia* reads "on the prairies in moist places, from Arkansas to Red River". A collection in the Herbarium of the Academy of Natural Sciences, Philadelphia labeled "D. *parviflorum? cf. variegat. Ark." may represent one of the specimens on which Nuttall based his description. A specimen in the Gray Herbarium, labeled by Engelmann "along Arkansas River opposite Fort Smith, June, 1835", is considered an authentic Nuttall collection. This information was supplied by Dr. C. E. Kobuski. I have examined both sheets, and they represent the species as I interpret it.

P. intermedia often grows as an aquatic, but it is found usually in wet periodically flooded areas. As an aquatic it produces long slender lateral rhizomes, forming compact colonies. Plants often sucker at the basal nodes.

The species has thin, dark green, linear or lanceolate leaves. The sinuate-repand margin of the blades usually is subentire, but sometimes dentate with obtuse often obscure teeth. The small lavender flowers rarely exceed 20 mm. in length. Among the Texas species, only the closely related *P. micrantha* Lundell has smaller corollas.

PHYSOSTEGIA ANGUSTIFOLIA Fernald, Rhodora 45: 462–463, *pl. 785, figs. 2–7*. 1943. Figs. 10, 11, and 12.

Physostegia edwardsiana Shinners, Field Lab. 19: 167–168. 1951.

TEXAS: Bandera County, 8 miles south of Bandera, June 5, 1933, *V. L. Cory 6607* (GH). Bexar County, on mud along bank, Helotes Creek, June 13, 1919, *Ellen D. Schulz 115* (US). Blanco County, between Johnson City and Dripping Springs, off U. S. highway 290, in marshy area, June 8, 1945, *C. L. Lundell & Amelia A. Lundell 13851*, type collection of *P. edwardsiana* Shinners (LL), corolla pale lavender; Johnson City, marshy bed of small stream crossing U. S. highway 290 in heart of town, June 8, 1958, *C. L. Lundell 15104* (LL), erect herb, corolla pale lavender, purple maculate; same locality and date, *Lundell 15105* (LL), erect, leaves serrulate to base or nearly so, petioles winged, corolla pale lavender, purple maculate; off U. S. highway 290, below McCall Creek, on marshy bank of Pedernales River (across road from cemetery) about 1 mile from type locality of *P. edwardsiana*, June 8, 1958, *Lundell 15107* (LL), corolla pale lavender, purple maculate; Johnson City, in marshy bed of small stream in heart of town, Aug. 10, 1958, *Lundell & Lundell 15123* (LL), slender rhizomes and basal buds from underground stems of plants of past season. Bowie County, 6 miles east of New Boston, May 20, 1937, *Cory 23020* (GH); about 3.6 miles southwest of Boston, in wet roadside ditch off highway 98, June 6, 1959, *Lundell & Lundell 16031* (LL), perennial herb with basal buds, corolla pale lavender, almost white; about ½ mile west of Hooks, along roadside ditch, off U. S. highway 82, June 7, 1959, *Lundell & Lundell 16039* (LL), perennial herb with basal buds and creeping rhizomes, corolla pale

Fig. 10. *Physostegia angustifolia* Fernald, type specimen, *C. A. & Una F. Weatherby 6318* (GH), ×½. Illustrated by Phoebejane Horning.

Fig. 11. *Physostegia edwardsiana* Shinners, isotype, *C. L. Lundell & Amelia A. Lundell 13851* (LL), ×½. Illustrated by Phoebejane Horning.

lavender, purple maculate. Burnet County, 4 miles west of Bertram, July 1, 1949, *C. M. Rogers, C. C. Albers & Joe Barksdale 6870* (PH). Kendall County, Boerne, wet rocky ground along streams, June 13, 1917, *E. J. Palmer 12237* (US). Kerr County, Kerrville, June 25, 1894, *A. Arthur Heller 1906* (GH); 14 miles west of Kerrville, along Turtle Creek, July 29, 1939, *Cory 32512* (GH), dry fruiting stems; in wet sand on edge of wooded stream along route 16, 7 miles north of Kerrville, June 29, 1957, *D. S. Correll & I. M. Johnston 17222* (LL), flowers pink with a spotted throat; same locality and date, *Correll & Johnston 17223* (LL), plant decumbent at base, flowers pure white. Llano County, Honey Creek, below the bridge off highway 71, bordering stream, June 9, 1958, *Lundell 15112* (LL), stems erect, often branched from base, leaves up to 1 in. wide, corolla a washed out lavender, purple maculate. San Saba County, off highway 16, north of Cherokee, below bridge in marshy bed of Cherokee Creek, June 9, 1958, *Lundell 15113* (LL), stems erect, branched from base, corolla pale lavender, purple maculate. ARKANSAS: Nevada County, off U. S. highway 67, southwest edge of Prescott, in ditch along railroad, June 6, 1959, *Lundell & Lundell 16032* (LL), perennial herb, rhizomatous, the rhizomes slender and white, corolla pale lavender, purple maculate. Hempstead County, off U. S. highway 67, about 2 miles east of Fulton, in ditch along railroad, June 6, 1959, *Lundell & Lundell 16033* (LL), rhizomatous, corolla pale lavender, purple maculate. MISSISSIPPI: Chickasaw County, near Egypt, May 18, 1933, *C. A. & Una F. Weatherby 6318*, type of *P. angustifolia* Fernald (GH), corolla white or slightly purple-tinged.

P. angustifolia, as represented in Texas and western Arkansas, is remarkably uniform when extensive populations are examined.

The corolla varies from pure white to lavender, and in Texas and western Arkansas, the lobes are usually purple-maculate. Only in one instance, along Cherokee Creek in San Saba County, Texas, was a plant observed with reddish-purple corollas. Since the species is related to *P. pulchella* Lundell, which has reddish-purple corollas, this could be expected.

The plants vary greatly in size, ranging from depauperate ones scarcely more than 60 cm. high to robust individuals measuring up to 2 meters in height.

The smaller plants have narrow linear-lanceolate leaves, as in the type, while the robust ones have lanceolate blades up to 2.5 cm. wide, and 22 cm. long (see figs. 10, 11, 12). The characteristic serrate margins of the larger leaves, with their sharp apically enlarged hooked teeth, give the species a superficial resemblance to *P. virginiana* (L.) Benth. Margins of the smaller leaves, as in the type of the species, are serrulate. *P. angustifolia* differs markedly from *P. pulchella* in leaf form, as shown in figs. 12 and 13.

P. angustifolia is a perennial. In loose sandy or gravelly soil, it produces creeping lateral rhizomes up to 30 cm. long. In heavy silt and clay, the basal buds give rise to primary rhizomes, as in *P. pulchella* Lundell (Wrightia 2: 4–7, *fig. 3.* 1959).

In northeastern Texas and southeastern Arkansas, *P. angustifolia* abounds in roadside colonies, and in fallow fields. But on the Edwards Plateau of Texas, under less humid conditions, the plants are rather rare, and they are to be found only in marshy areas and along mountain streams.

I am indebted to Dr. Reed C. Rollins, Director of Gray Herbarium of Harvard University, for making the type of *P. angustifolia* available for study.

PHYSOSTEGIA PULCHELLA Lundell, Wrightia 2: 4–8, *figs. 2, 3.* 1959. Fig. 13.

TEXAS: Austin County, clayey soil of prairie north of Wallis, May 4, 1920, *Francis W. Pennell 10290* (LL), corolla pink. Brazoria County, Columbus, common on prairie, April 30, 1900, *B. F. Bush 182* (US). Collin County, along ditch on route 6, 3 miles west of Josephine, May 22, 1959, *D. S. Correll & I. M. Johnston 22149* (LL), flowers lavender-pink. Dallas County, May, 1928, *Albert Ruth 1392* (US). Delta County, 5½ miles northeast of Cooper, May 22, 1937, *V. L. Cory 23298* (GH). Fort Bend County, April 20, 1899, *W. L. Bray 108* (US). Freestone County, in sandy woods 1 mile southeast of Streetman, May 24, 1957, *D. S. Correll & G. Edwin 16409* (LL), flowers pink-lavender. Grimes County, along roadside bank in dry soil, about 2 miles south of Navasota, May 31, 1958, *D. S. Correll & Helen B. Correll 18887* (LL), flowers clear pink-lavender. Harris County, alt. 50 ft., April 22, 1939, Texas Highway Department *39140* (US). Henderson County, near Athens, in roadside ditch, 1940, *Ottys Sanders 146* (LL). Hunt County, off U. S. highway 67, southwest of Caddo Mills, in ditch along railroad, May 29, 1958, *C. L. Lundell 15063* (LL), erect, corolla lavender, purple maculate; off highway 34, about 10 miles north of Greenville, in low bottoms, May 29, 1958, *Lundell 15064* (LL), erect herb, petioles winged, corolla pinkish-lavender, maculate; in creek bottom land on east edge of Greenville, May 24, 1958, *D. S. Correll & C. L. Lundell 18885* (LL), plants with short stolons, flowers pink-lavender with a striped throat; off U. S. highway 67, 3 miles southwest of Caddo Mills, along roadside in blackland prairie, May 3, 1945, *Lundell 13677* (LL), plants erect, corolla violet, maculate; off U. S. highway 67, Sabine River bottoms, at Greenville, June 11, 1958, *Lundell 15116* (LL), plants erect, basal bud developing at end of flowering season. Jasper County, in wet depression along route 62, 6 miles south of Buna, May 24, 1959, *D. S. Correll, I. M. Johnston & G. Edwin 22299* (LL), plants rhizomatous, flowers deep pink. Lamar County, off U. S. highway 82, about 2½ miles west of Paris, in roadside ditch, May 29, 1958, *Lundell 15071* (LL), erect herb, corolla deep pinkish-lavender, maculate. Leon County, in wet meadow along route 7, 2–3 miles west of Trinity River bridge, May 26, 1959, *Correll, Johnston & Edwin 22372* (LL), flowers pink. Limestone County, Groesbeck, wet open ground, June 1, 1915, *E. J. Palmer 7838* (PH). Madison County, in wet grassy area about 3 miles north of Madisonville, May 3, 1958, *Correll 18745* (LL), flowers pink-purplish with deeper purple spots; off U. S. highway 75, 8.5 miles southeast of Madisonville, on bottom land alluvium, May 26, 1959, *Lundell 16029* (LL), perennial, corolla red-purple, maculate. Navarro County, off highway 31, bottoms of Chambers Creek, June 4, 1958, *Lundell 15094* (LL), erect, corolla deep lavender, purple-maculate; in flooded meadowland along Richland Creek, May 26, 1959, *Correll, Johnston & Edwin 22415* (LL), flowers pink. Red River County, off U. S. highway 271, in low bottom land between Deport and Bogata, about 2½ miles northwest of Bogata, May 29, 1958, *Lundell 15072* (LL), erect herb, corolla lavender, purple maculate. Robertson County, off U. S. highway 79, at Hearne, in roadside ditch, April 28, 1941, *C. L. Lundell & Amelia A. Lundell 10378* (LL, US), corolla purplish, maculose; ⅛ mile northwest of Benchley, a colony in borrow ditch of highway, May 5, 1949, *Cory 55736* (US), stems erect, up to 8 dm. high. Walker County, about 8.5 miles west of

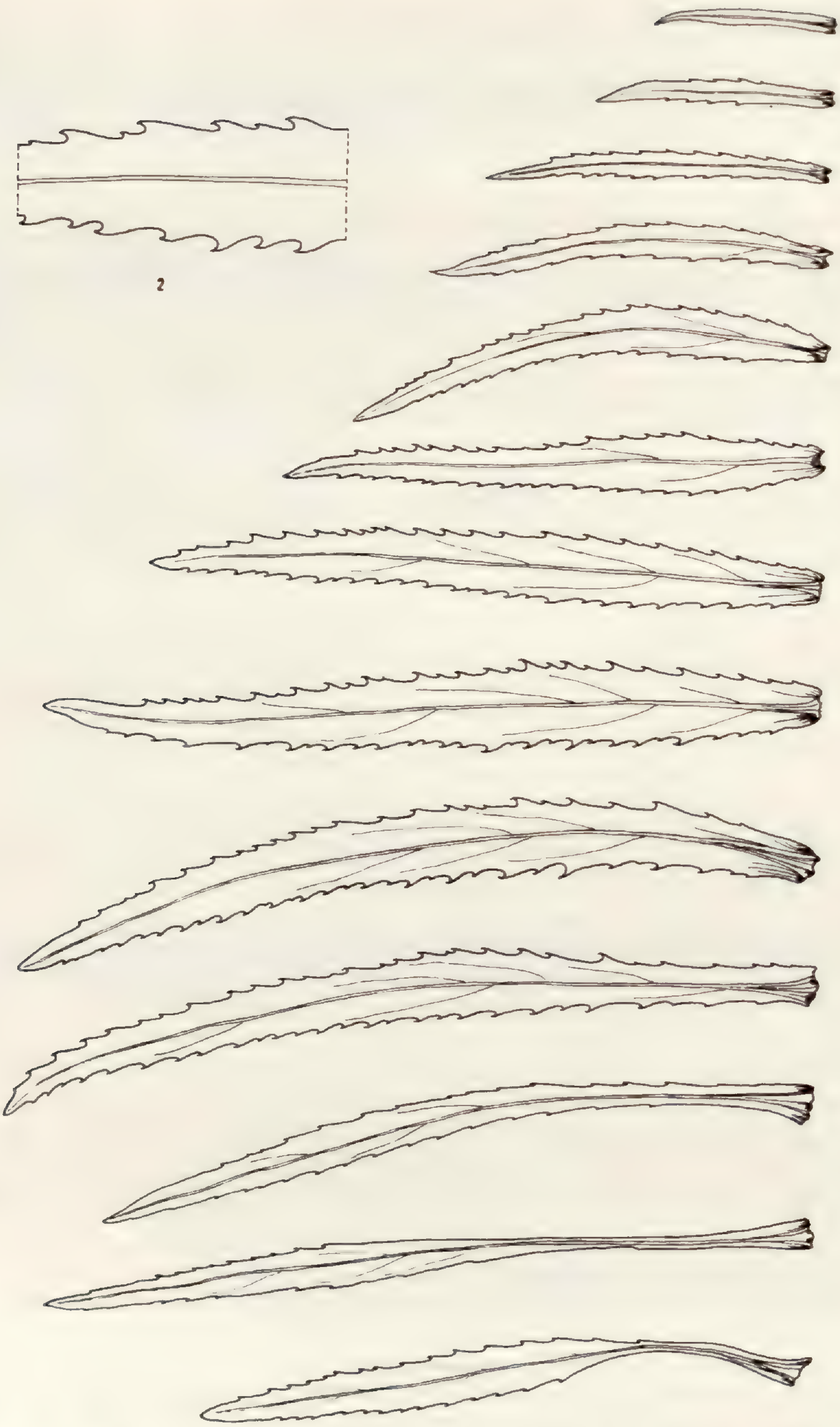

Fig. 12. *Physostegia angustifolia* Fernald, *C. L. Lundell & Amelia A. Lundell 16031* (LL): 1, leaf forms of a typical plant, the basal at bottom, ×½; 2, enlarged section of leaf margin showing hooked teeth. Illustrated by Phoebejane Horning.

Fig. 13. *Physostegia pulchella* Lundell, showing leaf forms, ×1½: 1, basal leaf in winter rosette; 2, pandurate type from middle stem, *D. S. Correll, I. M. Johnston & G. Edwin 22299* (LL); and 3, leaves from the type collection, the basal at bottom, *C. L. Lundell 16026* (LL). Illustrated by Phoebejane Horning.

Huntsville, off highway 45, at West Fork of San Jacinto River, roadside, May 26, 1959, *Lundell 16027* (LL), perennial with basal buds and short rhizomes, corolla tinged lavender; same date and locality, *Lundell 16028* (LL), corolla red-purple. Van Zandt County, 1⅔ miles west of Wills Point, a colony in broad, shallow borrow ditch, May 21, 1949, *Cory 56225* (US), stems erect, simple, up to 8 dm. high.

P. pulchella and *P. angustifolia* are distinguished as follows:

Leafy nodes 9–15; leaves linear-lanceolate or lanceolate, the margins sharply serrulate or serrate, often with hooked teeth, the basal third sometimes subentire; calyx 6–10 mm. long; corolla 2.5–3.5 cm. long, white or pale lavender.....*P. angustifolia.*

Leafy nodes 7–9; leaves oblong-lanceolate or oblanceolate, sometimes pandurate, the margins dentate or dentate-serrate, the amplexicaul base often sharply dentate; calyx 4–7 mm. long; corolla 1.8–2.5 cm., rarely up to 3 cm. long, usually reddish-purple.....*P. pulchella*.

Some plants in the collection from Red River County, *Lundell 15072*, have the long narrow lanceolate leaves of *P. angustifolia.*

From Jasper County, *Correll, Johnston & Edwin 22299* is the first collection I have seen with strong lateral rhizomes. Also, these plants of *P. pulchella* have very distinctive pandurate middle stem leaves, a noteworthy characteristic which is present but less striking in other collections of the species (see fig. 13).

NOTE

BAHIA WOODHOUSEI IN EXTREME WESTERN TEXAS.—The occurrence of this species in Texas was apparently first recorded by S. F. Blake (Kearney & Peebles, *Flowering Plants and Ferns of Arizona*, p. 983, 1942, repeated in *Arizona Flora*, p. 925, 1951). Blake gives the distribution as northwestern Texas, Colorado, and northern Arizona. I can now report its occurrence in extreme western Texas, documented by the following collection in the herbarium of Sul Ross State College: Culberson County, infrequent along highway, limestone, Cherry Canyon, 5 miles east of Pine Springs station, near the Guadalupe Mountains, alt. 5100 feet, *Warnock 6311*, July 5, 1947. The full citation is *Bahia Woodhousei* (Gray) Gray, Proc. Amer. Acad. 19: 28, 1883, and Syn. Fl. No. Amer. 1(2): 333, 1884, and 2nd edition, 1886 [named spelled *Woodhousii* by Gray], based on *Achyropappus Woodhousei* Gray, Proc. Amer. Acad. 6: 546, 1865. "Northern part of New Mexico," *Dr. Woodhouse* (GH?). *Picradeniopsis Woodhousei* (Gray) Rydberg, Bull. Torrey Bot. Club 37: 333, 1910 and No. Amer. Fl. 34: 34, 1914.—Barton H. Warnock, Sul Ross State College, Alpine, Texas.

ACANTHACEAE AMERICANAE NOVAE VEL CRITICAE

Emery C. Leonard

In the U. S. National Herbarium the collection of Acanthaceae has reached considerable size. Among the specimens filed there are many sheets bearing *nomen nudum* determinations, others incorrectly named. Some of the genera are badly in need of revision. A series of short papers is planned whereby these specimens can be described and their names validly established. New species in recent collections and loans received by the U. S. National Museum will also be treated in this series.

In the present paper one new species from North Caicos Island, West Indies, and two from Brazil are described and illustrated.

WEST INDIES, North Caicos.

Stenandrium Carolinae Leonard & Proctor, sp. nov. Fig. 14.

Herba acaulis, lamina foliorum elliptica, apice rotundata vel obtusa, basi obtusa vel acuta, aliquanto firma, marginibus leviter crenatis, utrinque subtomentosa, supra pilis appressis curvatis albis, pilis paucis longis e basi conica exeuntibus intermixtis, subtus pilis numerosis curvatis brunneis, costa et venis lateralibus obscuris; petioli tomentosi, pilis parvis multis retrorsis, pilis paucis longis patulis intermixtis; spicae sublaxae, rhachibus parce puberulis, pilis retrorsis; spicae et pedunculi quam folia longiores; bracteae lanceolatae, acutae, puberulae, pilis multis, appressis vel ascendentibus, marginibus ciliatis, pilis patulis, costa et nervis lateralibus obscuris et gracilibus; bracteolae parvae, lanceolatae, parce puberulae, costa et nervis lateralibus gracilibus; calycis segmenta lanceolata, puberula; corolla punicea, tubo cylindrico, lobis limbi obovatis extus glabris, intus minute furfuraceis, in fauce hirtella; ovarium apice hirtellum, cetera glabrum.

Acaulescent herbs up to 12 cm. high from short root stocks; leaf blades elliptic, up to 25 mm. long and 10 mm. wide, rounded or obtuse at tip, acute or rounded at base, rather firm, the margins shallowly crenate, both surfaces subtomentose, the hairs of the upper surface dense, white, appressed, curved, up to 0.4 mm. long, these intermixed with scattered much larger hairs, these up to 1.5 mm., curved, appressed or ascending, arising from conical bases, the hairs of the lower surface dense, brownish, curved, appressed or ascending, up to 0.16 mm. long, the costa and lateral veins (3 or 4 pairs) obscured by the pubescence; petioles up to 25 cm. long, tomentose, the smaller hairs dense, retrorse, up to 0.16 mm. long, these intermixed

Fig. 14. *Stenandrium Carolinae* Leonard & Proctor (*Proctor 9094*). a, Plant; b, tip of leaf blade (lower surface); c, tip of leaf blade, upper surface; d, bract; e, bractlet; f, calyx spread to show segments; g, limb of corolla.

with scattered spreading hairs up to 2 mm. long; flowers borne in rather lax spikes up to 4 cm. long and 8 mm. broad (without corollas), the rachis 0.5 to 0.75 mm. thick, sparingly puberulous, the hairs retrorse, about 0.11 mm. long or a few larger ones as much as 0.25 mm. long, the peduncles up to 6 cm. long, conspicuously longer than the leaves, 0.75 mm. broad, the pubescence that of the rachis, rarely a flower borne at the middle of the peduncle; bracts lanceolate, 8 mm. long, 1.5 mm. wide at base, thence gradually narrowed to tip, the hairs dense, appressed or ascending, up to 0.2 mm. long, the margins ciliate mostly from below middle to tip, the hairs spreading, up to 1 mm. long, the costa and lateral nerves delicate; bractlets lanceolate, 4 mm. long, 1 mm. wide at base, gradually narrowed to a sharp tip, sparingly puberulous, the hairs borne mostly from middle to tip, spreading or ascending, up to 0.25 mm. long, the costa and lateral nerves, usually a pair, delicate; calyx 5 mm. long, the segments lanceolate, 3 to 3.5 mm. long, 0.5 mm. wide at base, puberulous mostly from tip to middle, the hairs ascending to retrorse, up to 0.16 mm. long; corolla pink (Proctor), 8 to 10 mm. long, the tube cylindric, about 1 mm. in diameter, the limb 1 cm. broad, the lobes obovate, 5 to 9 mm. long, 2.5 to 6 mm. wide, rounded at tip, the outer surface glabrous, the inner minutely scurfy, the base of the largest lobe hirtellous with stiff erect acute hairs up to 0.16 mm. long; ovary about 2 mm. long, glabrous except at tip, here hirtellous with spreading hairs up to 0.16 mm. long; style slender, 5 mm. long, glabrous, the stigma minute.

Type in the U. S. National Herbarium No. 2279920, collected in dry sandy soil at Whitby, North Caicos, West Indies, by George R. Proctor (No. 9094).

This new species is named for Miss Caroline Bleakley, the young and charming daughter of Mr. Peter Bleakley, Commissioner of the Turks and Caicos Islands. It was through Mr. Bleakley's assistance and generous hospitality that Mr. Proctor was able to make extensive collections on the Caicos Islands.

Stenandrium Carolinae is closely related to *S. bracteosum* Britton of the Bahamas. That plant, however, has no dense understory of curved hairs, the bracts are densely white-pilose, the calyx segments are relatively broader and the spikes longer with shorter peduncles, these exceeded by the leaves. However, Britton's combination has not previously been formally published.

Stenandrium bracteosum (Britt. & Millsp.) Britton, comb. nov.

Gerardia bracteosum Britt. & Millsp., Bahama Flora 402. 1920.

BRAZIL

Justicia Cowanii Leonard, sp. nov. Fig. 15.

Herba usque ad 0.75 m. alta, caulibus erectis vel ascendentibus, subquadrangularibus, parce et minute hirtellis, basi 2 mm. crassis; laminae

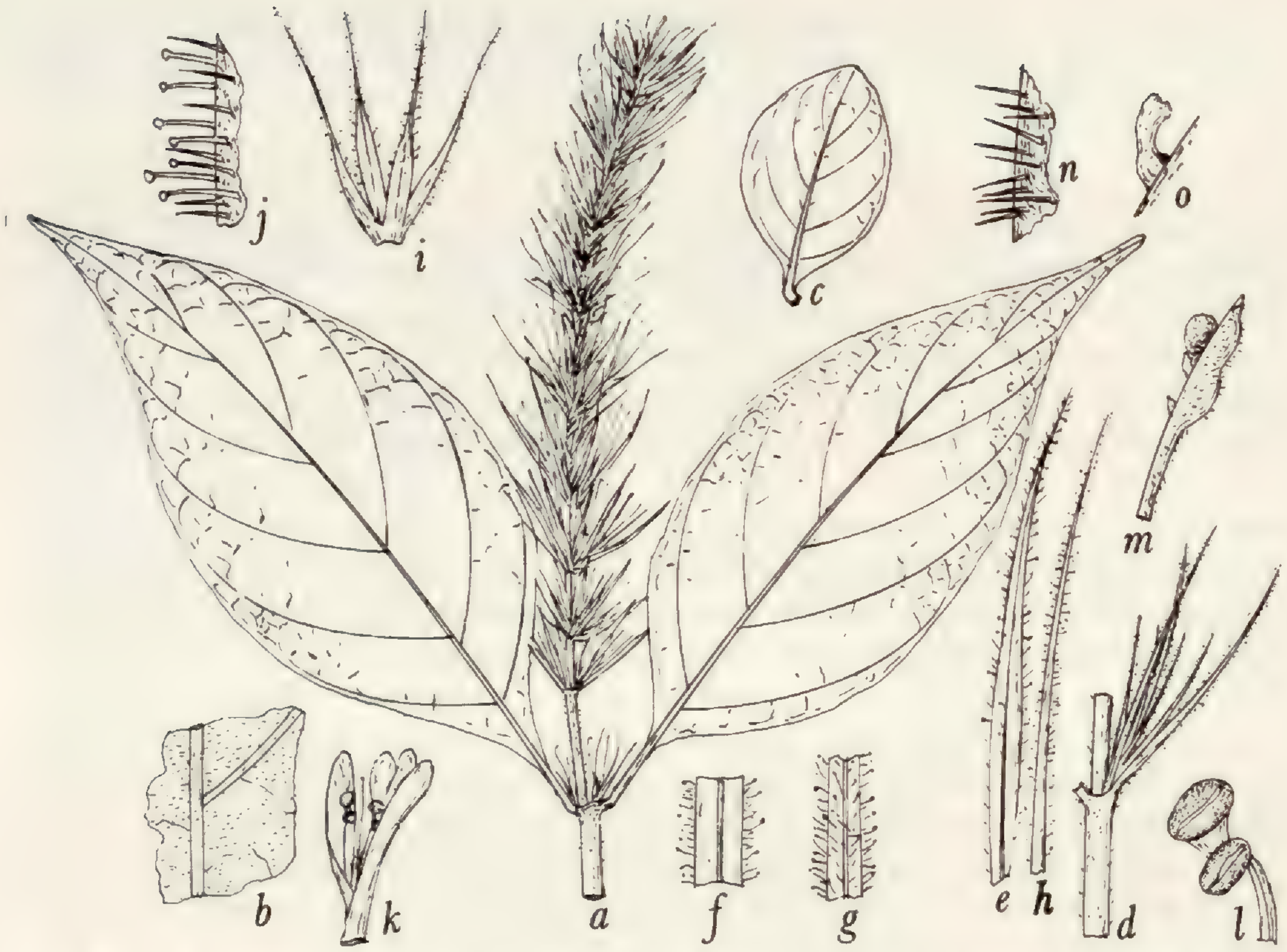

Fig. 15. *Justicia Cowanii* Leonard (*Cowan 38150*). a, Tip of plant showing leaves and spike; b, portion of leaf blade enlarged to show cystoliths; c, basal leaf; d, node of spike showing bract, bractlets and calyx; e, bract; f, portion of bract enlarged to show pubescence (ventral surface); g, same (dorsal surface); h, a bractlet; i, calyx; j, portion of calyx enlarged to show pubescence; k, tip of corolla; l, anther; m, valve of capsule; n, portion of capsule wall enlarged to show pubescence; o, retinaculum.

foliorum ovato-lanceolatae vel inferiores ovatae, 2–9 cm. longae, 1.2–2.2 cm. latae, obtusae vel breviter acuminatae (apice ipso obtuso), basi acutae, integrae, aliquanto firmae, glabrae vel parce hirtellae, pilis rigidis, acutis, curvatis, usque ad 0.16 mm. longis, praecipue in costa et venis (6 vel 7 paribus) positis, subtus costa et venis et venulis crasse reticulatis prominentibus, supra obscuris, cystolithis pluribus, usque ad 0.16 mm. longis; petioli 5 mm. longi, puberuli; spicae terminales et laterales, sessiles vel pedunculatae; pedunculi usque ad 2.5 cm. longi parce puberuli, pilis curvatis, 0.16 mm. longis; bracteae subulatae, 10–11 mm. longae, 0.75 mm. latae, intus glabrae, extus puberulae, pilis usque ad 0.08 mm. longis, plus minusve patulis, pilis acutis et pilis glandulosis intermixtis, costa prominente; bracteolae bracteas similis sed solum 0.5 mm. latae; calycis segmenta 4, lanceolata, apice subulata, 6 mm. longa, 0.5 mm. lata, intus glabra, extus puberula, pilis bracteae et bracteloae similibus, costa prominente; corolla 15 mm. longa, violacea, hirtella, pilis patulis, acutis, usque ad 0.16 mm. longis, tubo gracili, 1.5 mm. lato, prope orem 2 mm. lato, labiis circa 6 mm. longis, labio superiore oblongo-ovato, basi 2 mm.

lato, apice 0.5 mm. lato, obtuso, labio inferiore cuneato, apice circa 4 mm. lato, trilobato, lobis circa 3 mm. longis, oblongis, apice rotundatis, lobo medio circa 2.5 mm. lato, lobis lateralibus 1.5 mm. latis; stamina 2–3 mm. supra orem corollae exserta, lobis antherarum superpositis, obliquis, ovatis, lobo superiore 0.75 mm. longo, 0.5 mm. lato, lobo inferiore leviter minore, connectivo truncato, plano, circa 0.25 mm. longo, 0.5 mm. lato, capsulae clavatae, 7.5 mm. longae, 2 mm. latae, 1.5 mm. crassae, subobtusae, minute hirtellae, pilis patulis vel basi retrorsis, acutis, usque 0.128 mm. longis, callo minute striato; semina 2 vel 4, ovata, plana, rubiginosa, minute et parce punctata, 2 mm. longa, 1.25 mm. lata, circa 0.25 mm. crassa; retinacula leviter sigmoidea, 1 mm. longa, apice circa 0.25 mm. lata, plana, fimbriata.

Herbs up to 75 cm. high, the stems erect or ascending, subquadrangular, sparingly and minutely hirtellous; leaf blades ovate-lanceolate or the lowermost ovate, 2 to 9 cm. long, 1.2 to 2.2 cm. wide, obtuse or shortacuminate (the tip itself obtuse), acute at base, entire, glabrous or sparingly hirtellous with small rigid acute curved hairs, the costa and lateral veins of the lower surface prominent, the veinlets coarsely reticulate, the venation of the upper surface obscure, the cystoliths numerous; petioles 5 mm. long, puberulous; spikes terminal and lateral, sessile or on peduncles up to 2.5 cm. long, these sparingly puberulous with minute hairs; bracts subulate, 10–11 mm. long, 0.75 mm. wide, glabrous within, puberulous without with a mixture of minute glandular and acute more or less spreading hairs, the costa prominent; bractlets similar to the bracts but narrower; calyx segments lanceolate, 6 mm. long and 0.5 mm. wide, ending in a subulate tip, glabrous within, puberulous without, the hairs similar to those of the bracts and bractlets, the costa prominent; corolla 15 mm. long, violet, hirtellous, the tube slender, 1.5 mm. broad, the throat 2 mm. broad, the lips 6 mm. long, the upper one oblong-ovate, 2 mm. broad at the base, 0.5 mm. wide at the tip, obtuse, the lower lip cuneate, about 4 mm. wide, 3-lobed, the lobes 3 mm. long, rounded at tip, the middle lobe 2.5 mm. wide, the lateral ones 1.5 mm. wide; stamens exserted 2 to 3 mm. beyond the mouth of the corolla, the lobes ovate, 0.75 mm. long, 0.5 mm. broad, superposed and obliquely attached to the connective, rounded or obscurely and minutely mucronate at base; capsules clavate, 7.5 mm. long, 2 mm. broad, 1.5 mm. thick, subobtuse, minutely hirtellous, the hairs minute, spreading or retrorse towards the base of the capsule, the callus minutely striate; seeds 2 or 4, ovate, flattened, 2 mm. long, 1.25 mm. broad, 1.25 mm. thick, reddish, minutely and sparingly punctate or papillate; retinacula slightly sigmoid, 1 mm. long, the tip flattened and fimbriate.

Type in the U. S. National Herbarium, No. 2174979, collected on slopes of Observatorio Ore Body, Sierra do Navio, Amapá, Brazil, 70–300 meters altitude, November 8, 1954, by Richard S. Cowan (No. 38150).

Data on holotype label: "Low herb to 0.75 m. tall. Fls. violet. Common in old roads on lower slopes of Observatorio Ore Body." *Justicia Cowanii* appears to have no close relatives in Amapá.

b
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Chaetothylax Hatschbachii Leonard, sp. nov. Fig. 16.

Herba decumbens, caulibus subquadrangularibus cinereis, 4-striatis (striis viridibus), nodis tumidis, bifariam hirtellis, pilis patulis vel retrorsis; lamina foliorum lanceolata, acriter acuminata, basi acuta, aliquanto firma, integra vel leviter undulata, utrinque glabra, costa et venis lateralibus obscuris parce pilosis exceptis, cystolithis prominentibus; petioli glabri vel parce puberuli; spicae terminales et axillares, leviter curvatae, densae, floribus secundis, pedunculis brevibus, angulatis, puberulis bifariam hirsutis; bracteae subulatae carinatae, acriter acuminatae, apice subhyalinae, glabrae, marginibus ciliatis; bracteolae bracteis similes sed angustiores; calycis segmenta linearia, apice acriter acuta, subhyalina, parce puberula, pilis acutis et glandulosis intermixtis praedita, marginibus albis, ciliatis; corolla lilacina (tubo pallido), minute et parce puberula, labio superiore suberecto, anguste ovato, apice rotundato, labio inferiore patulo 3-lobato lobis rotundatis, lobo medio quam lobis lateralibus latioribus; stamina vix exserta, in labio antico corollae declinata, antheris glabris, filamentis glabris, planis; capsulae clavatae, minute puberulae; retinacula triangularia, apice crassa, rotundata; semina hirtella.

Decumbent herbs up to 30 cm. high or more; stems subquadrangular, grey with 4 narrow green striae, the internodes 3–4 cm. long, the joints swollen, the hairs spreading or retrorse, up to 0.5 mm. long, bifariously arranged; leaf blades lanceolate to oblong-lanceolate, up to 10.5 cm. long and 3.5 cm. wide, sharply acuminate, acute at base, rather firm, entire or shallowly undulate, drying olive green, glabrous on both surfaces except the costa and lateral veins (6 to 8 pairs), these obscure, and sparingly pilose, the hairs ascending, up to 0.3 mm. long, the cystoliths rather prominent, up to 0.25 mm. long; petioles up to 1 cm. long, glabrous or bearing a few minute curved hairs; flowers dense, secund, borne on curved terminal and axillary spikes 3–5 cm. long, these forming a rather large leafy panicle, the rachis angular, puberulous, the hairs spreading or ascending, up to 0.13 mm. long, the peduncles 5 to 10 mm. long, bifariously hirsute with retrorsely curved and more or less appressed hairs up to 0.32 mm. long; bracts subulate, 3.5 mm. long, 0.5 mm. wide at base, carinate, gradually narrowed to a sharp subhyaline tip, glabrous except the margins, these ciliate, the hairs, more or less curved, mostly ascending up to 0.8 mm. long; bractlets similar to the bracts but slightly narrower; calyx 7.5 mm. long, the segments linear, 7 mm. long, 0.5 mm. wide near middle, sharply acute with subhyaline tip, the inner surface glabrous, the outer rather sparingly puberulous with both glandular and acute hairs up to 0.08 mm. long, the margins white

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Fig. 16. *Chaetothylax Hatschbachii* Leonard (a–i, *Hatschbach 5419*; j, k, *Hatschbach 5991*). a, Tip of plant; b, portion of leaf blade in detail (upper surface) to show cystoliths and scattered hairs; c, same of lower surface; d, portion of stem showing the bifarious pubescence; e, node showing bracts, bractlets and calyx; f, calyx segment; g, portion (middle, inner surface) of calyx segment showing ciliation; h, a portion of calyx segment enlarged to show glandular and acute hairs; i, portion (middle, outer surface) of calyx segment showing ciliation, glandular and eglandular hairs; j, tip of corolla; k, anther.

ciliate with spreading acute hairs up to 0.08 mm. long; corolla lips lilac, the tube whitish, 12 mm. long, the lower half glabrous, the upper half minutely and sparingly puberulous with more or less spreading acute hairs up to 0.16 mm. long, the tube 7 mm. long and 1.5 mm. broad at base, enlarged to 2 mm. above base, 3 mm. at mouth, the upper lip erect, narrowly ovate, rounded at tip, the lower lip more or less spreading, 3-lobed, the lobes 3 mm. long, rounded, the middle one 2 mm. wide, the lateral ones 1 mm. wide, the stamens exserted, partly enfolded by the upper lip of the corolla and reaching its tip, the anthers 1 mm. long and 0.5 mm. wide, glabrous, the filaments curved, flat, glabrous, the pistil slightly exceeding the upper corolla lip, the stigma minute, the larger lobe oval; ovary 1 mm. long, style sparingly puberulous, the hairs spreading, up to 0.08 mm. long; capsules 5 to 6 mm. long, 2 mm. broad, 1.5 mm. thick, the stipe flat, about 2 mm. long, the surface of the capsule minutely puberulous, the hairs up to 0.08 mm. long, spreading or toward the base of the capsule retrorse; retinacula triangular, 0.75 mm. long, thick and rounded at tip; seed hirtellous, the hairs about 0.01 long.

Type in the U. S. National Herbarium No. 2279916, collected on the Estrada do Turvo, Rio Ribeira, Cerro Azul, Paraná, Brazil, January 1, 1959, by G. Hatschbach, No. 5419. Isotype No. 2279917 (US). Paratype collected at Barra Grande, Bocaiuva do Sul, Paraná, 150 m. altitude, January 25, 1959, by G. Hatschbach No. 5591 (US).

Data on the holotype label: Erva decumbente, flor alva. Das matas proximas ao rio (terreno algo pedregoso).

Data on paratype label: Erva flor lilaz, da mata secundaria.

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A NEW STENANDRIUM FROM THE STATE OF DURANGO, MEXICO

Emery C. Leonard

For the period of sixty or more years two specimens, one collected by Edward Palmer, No. 392, and the other by E. W. Nelson, No. 4674, have rested unnoticed in a folder of unidentified Acanthaceae in the U. S. National Herbarium. Because of the odd appearance of the plants no attempt had ever been made to place them even in the genus. Recently Albert J. Hendricks, collecting for the Southern Illinois University, rediscovered the plant five miles south of Durango City, a locality about one hundred miles from Santiago Papasquiaro, the region where Palmer and later Nelson collected it.

After a careful study of the flower parts, I was able to place it in the genus *Stenandrium* in spite of its large size and verticillate leaves.

Stenandrium pelorium Leonard, sp. nov. Fig. 17.

Herbae grandes, caulibus subteretibus puberulis, pilis retrorse curvatis, albis; folia verticillata, 4 in verticillo, sessilia vel infima subsessilia, laminis oblongo-ovatis, apice subacutis, basi cuneatis, membranaceis, undulatis, utrinque hirtellis, pilis curvatis, ascendentibus, articulatis, subtus pilis in costa et venis lateralibus solum praeditis, spicae terminales vel laterales, pedunculatae, pedunculis et rhachibus puberulis; bracteae oblongae, apice rotundatae, basi cuneatae, membranaceae, integrae, costa et nervis lateralibus gracilibus, in superficie glabrae, marginibus ciliatis, pilis patulis; bracteolae lineares, glabrae, ciliatae, pilis patulis conspicuis; calycis segmenta linearia, apice acuta et apiculata, apiculo parvo, gracili, in superficie glabra, marginibus ciliatis, pilis patulis vel ascendentibus, conspicuis; pilis brevioribus glandulosis intermixtis; corolla rubra, parva, deorsum glabra, sursum retrorse pilosa, labio superiore 2-lobato, lobis ovatis, apice rotundatis, labio inferiore 3-lobato, lobis ovalibus, apice rotundatis; stamina vix exserta, filamentis dense pilosis; ovarium glabrum.

Herbs up to 50 cm. high; stems up to 5 mm. in diameter, subterete, puberulous, the hairs white, retrorsely curved, mostly from 0.16 to 0.32 mm. long; leaves borne in whorls of 4, the nodes 7 to 13 cm. apart, the blades sessile or lowermost subsessile, oblong-ovate, subacute at tip, cuneate at base, up to 9 cm. long and 4 cm. wide, thin, undulate, both surfaces hirtellous, the hairs white, jointed, curved, ascending, up to 0.56 mm. long, those of the lower leaf surface confined to costa and veins (6 to 8 pairs), the venation rather obscure, more so on the lower surface of the blades than on the upper, the lowermost whorl of leaves rhombic to suborbicular, 3 to 6 cm. long and 3 to 4 cm. wide, rounded or obtuse, on winged petioles about

Fig. 17. *Stenandrium pelorium* Leonard (*Palmer 392*). a, Tip of plant; b, portion of stem enlarged to show pubescence; c, a leaf from the lowermost whorl; d, calyx spread to show segments; e, bract; f, one of a pair of bractlets; g, corolla spread to show lobes; h, anther; i, small portion of calyx segment enlarged to show both gland-tipped and acute hairs.

5 mm. long, the pubescence that of the upper leaves; spikes lateral or terminal, 3 to 4 cm. long and 1 to 2 cm. wide, rounded at tip, borne on peduncles up to 2 cm. long, these puberulous, the hairs similar to those of the stems, the rachis puberulous, the hairs white, mostly spreading, and up to 0.4 mm. long; bracts oblong, up to 13 mm. long and 5 mm. wide, rounded at tip and cuneate at base, thin, entire, the costa and about 5 pairs of lateral nerves delicate, both surfaces glabrous, the margins ciliate, the hairs spreading, up to 0.75 mm. long, white; bractlets linear, thin, delicately nerved, subacute, 9 mm. long, 1.5 mm. wide, glabrous, the margins ciliate, the hairs white, up to 1.25 mm. long, spreading; calyx segments 1 cm. long, 2 mm. wide, acute and apiculate, (the apicula about 0.5 mm. long) glabrous, the margins conspicuously ciliate, the hairs white, spreading or ascending, up to 1.5 mm. long; these toward tip of calyx segments, intermixed with a few shorter (up to 0.25 mm.) gland-tiped ones; corollas red, 12 mm. long, 2 mm. broad at base, 3 mm. wide at throat, glabrous except the medial region, here sparingly and retrorsely pilose, the hairs from 0.25 to 0.5 mm. long, the upper lip suberect, 2-lobed nearly to base,

the lobes ovate, 4 mm. long and 3 mm. wide, rounded, delicately nerved, the lower lip spreading, 3-lobed the lobes oval, the middle one 4.25 mm. wide, the lateral lobes 4 mm. wide, all rounded at tip and delicately nerved; stamens barely exserted above the throat of the corolla, the anthers 1.5 mm. long and 0.75 mm. broad, the filaments 2 mm. long, the anterior pair densely pilose, the posterior one less so, the hairs whitish, spreading, about 0.5 mm. long; style about equaling the stamens, minutely 2-lobed; ovary glabrous.

Type in the U. S. National Herbarium, No. 304565, collected at Santiago Papasquiaro, Durango, Mexico, "April and August," 1896, by Edward Palmer (No. 392). Paratypes: E. W. Nelson, No. 4674, collected in the same locality August 7, 1898, and Albert J. Hendricks, No. 751, collected on the north side of a hill on the Schroeder Site 5 miles south of Ciudad Durango.

Stenandrium pelorium is indeed remarkable for its huge size if compared with the other species of the genus. Quadrate leaf whorls present a character not often found. One Mexican species, *S. verticillatum* Brandeg., however, has 4-leaved verticels but is a very tiny plant, rarely over 7 cm. high, and with leaf blades up to only 15 mm. long and 10 mm. wide. The flower parts of *S. verticillatum*, though much smaller than those of this new species, are strikingly similar.

The specific epithet is from the Greek πελώριος, meaning very large, huge.

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A RAPID FEULGEN-ACETOCARMINE SQUASH TECHNIQUE FOR ROOT TIP CHROMOSOMES

Robert E. Perdue, Jr.[1]

Abstract.—Root tips are treated in 0.1% colchicine solution for 1.5 hours and fixed in 3:1 ethyl alcohol-glacial acetic acid. After hydrolysis in N HCl at 57–60°C. for 10 minutes they are placed in decolorized Feulgen stain for 30 minutes. The stained portion of the root tip is placed in 2 drops of acetocarmine on a slide to which ¼ drop of iron solution is added. A cover slip is applied, then tapped with a pencil eraser to spread the cells in a thin film. The slide is blotted gently to remove excess stain, heated almost to the boiling point of the stain, blotted with maximum pressure and sealed with clear fingernail lacquer. Slides to be made permanent are immersed in acetone until the cover glass becomes loose. Slide and cover are passed through 3 changes of 95% alcohol and 1 change of absolute alcohol. The cover glass is remounted with diaphane.

The methods discussed in this paper were developed during the course of a cytotaxonomic study of species of *Rudbeckia* and have been used successfully with species of *Dracopis*, *Echinacea*, and *Ratibida*. Although the chromosomes of these genera are comparatively large they are not stained readily by acetocarmine and a satisfactory stain intensity cannot be achieved with the Feulgen method. Mediocre results obtained with the acetocarmine and Feulgen techniques suggested that a combined method might prove satisfactory. This double stain procedure, once perfected, resulted in excellent preparations.

Staining of the chromosomes by acetocarmine is intensified by the iron solution indicated in the schedule. This mordant was prepared by refluxing 1 gram of iron filings in 100 ml. of 45% acetic acid. The solution was heated to the boiling point and allowed to cool to room temperature. Alternate heating and cooling were repeated, two to three times, until the solution when cool was moderately dark brown in color. The solution should be as dark brown as possible, but without a precipitate. Excessive heat results in the formation of a brown colloidal precipitate, and an unsatisfactory reagent.

SCHEDULE

(1) Immerse excised root tips in 0.1% colchicine solution for 1.5 hours.
(2) Fix root tips in 3:1 ethyl alcohol-glacial acetic acid for several hours or longer.

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(3) Hydrolize in normal HCl at 57–60°C. for 10 minutes.

(4) Place in decolorized Feulgen stain (formula of Darlington and Lacour, 1950) for 30 minutes.

(5) Place 2 drops of acetocarmine (formula of Darlington and Lacour, 1950) on a slide and add about 0.5 mm. from the tip of 1 or 2 roots.

(6) Mix a small amount of iron solution (about one-fourth of a drop) with the acetocarmine.

(7) Add a cover glass. With the index and middle fingers, hold the cover tightly in place and spread the cells of the tissue out into a thin film by tapping the cover lightly with the rubber eraser of a pencil. Finally, tap the glass sharply several times to rupture the cell walls.

(8) Blot the slide lightly to remove the excess stain.

(9) Heat the slide almost to the boiling point of the acetocarmine.

(10) Blot the slide in a bibulous paper book, applying as much pressure as possible.

(11) Seal the margins of the cover glass with fingernail lacquer or other suitable preparation.

A thermostatically controlled oven was used for accurate temperature control during hydrolysis. Supplies of water and hydrochloric acid were stored in the oven. Prior to staining, the preheated water was poured into a beaker. The root tips were placed in a test tube and the tube was then filled with the preheated acid and placed in the water bath. By adding the root tip collections at intervals of 2 minutes as many as 6 collections can be run consecutively through the schedule described.

It is important that surplus acetocarmine be removed by light blotting (Step 8) before the slide is heated. This will prevent movement of the cover glass and resulting distortion of the cells when strong pressure is applied later to flatten the preparation. Since the contents of many cells have been freed from their walls, individual chromosomes or groups of chromosomes are readily separated from their companions and may be moved away if there is an excessive flow of stain.

Clear fingernail lacquer (Gerstel, 1953) has proved very satisfactory for sealing cover glasses. It can be rapidly applied to the margins of the cover glass, and preparations sealed in this manner will not dry out for several weeks if stored in a moist atmosphere. Slides sealed with fingernail lacquer can conveniently be made permanent. After removing the sealant by immersing the slide in acetone, the slide and cover glass should be passed through 3 changes of 95% ethyl alcohol and one change of absolute ethyl alcohol and then remounted with diaphane. In slides over 2 years old there is no change in the appearance of the chromosomes or the cytoplasm.

The procedure outlined above produces preparations in which the chromosomes are deeply stained and in great contrast to the often colorless, unstained cytoplasm. They are in a single plane and are excellent subjects for photography. The cells are not spread over the entire area under the cover glass. Those from each root tip used are arranged in a single layer and limited to a restricted area, and the important areas of the slide can be scanned very quickly. In carefully prepared slides there are usually many

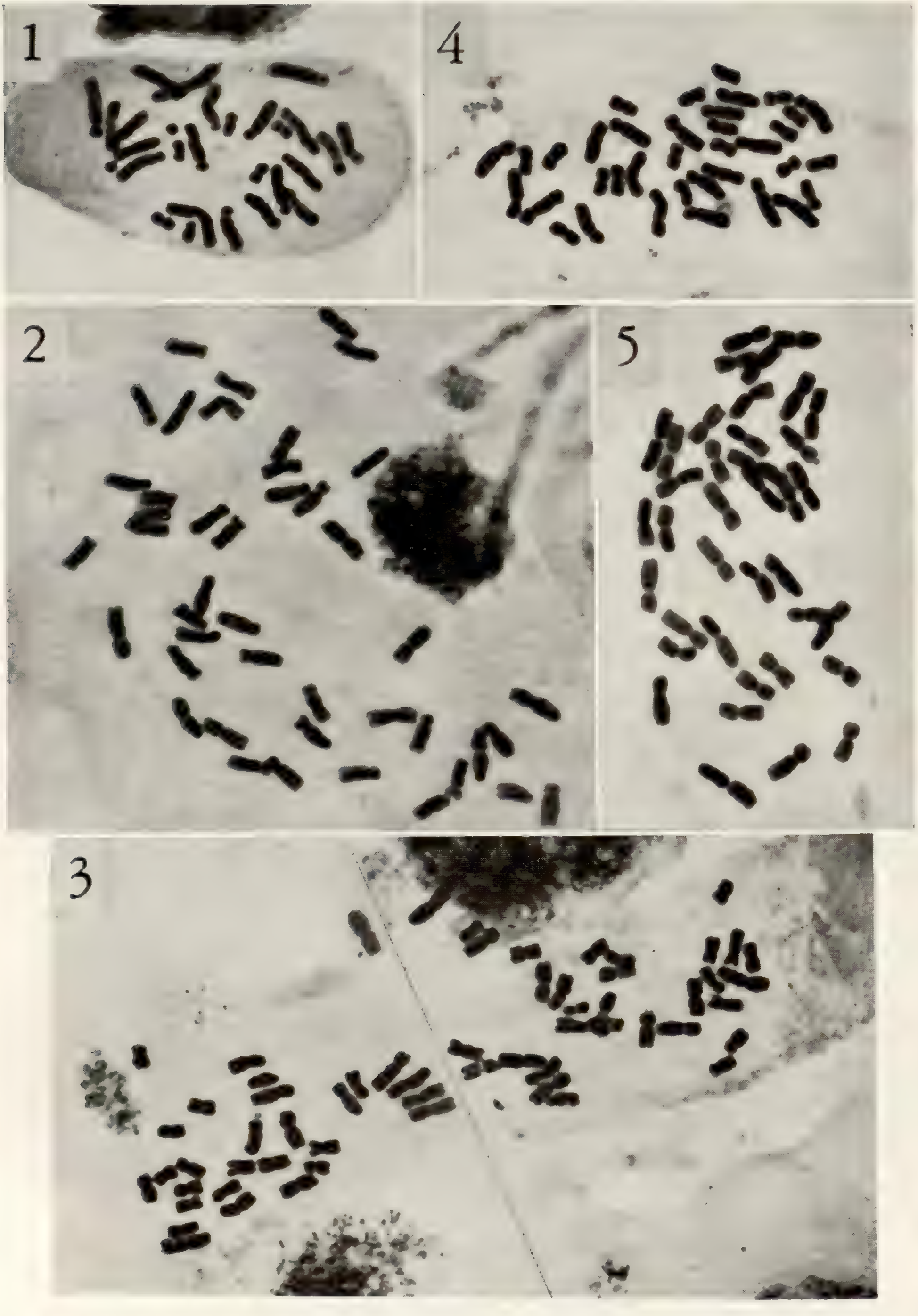

Fig. 18. Chromosomes of species of *Rudbeckia*, *Ratibida*, and *Echinacea* stained by the Feulgen-acetocarmine technique, mitotic metaphases from root tips: 1, *Ratibida columnifera*, 2n = 26 (1425×); 2, *Echinacea pallida*, 2n = 44 (1350×); 3, *Rudbeckia triloba* var. *triloba*, triploid-aneuploid with 2n = 58 (1425×); 4, *R. mohrii*, 2n = 36 (1425×); 5, *R. subtomentosa*, 2n = 38 (1425×).

cells in which the chromosomes are sufficiently scattered that all or most members of the complement can be studied individually.

For the plants that I have examined, this technique has proved most satisfactory during spring and early summer. Many preparations stained unsatisfactorily during midsummer and late summer, especially when the plants were beginning to flower and the roots were less vigorous.

Highly accurate counts of up to 76 chromosomes were rapidly made from material prepared as outlined. Where numbers were high, speed and accuracy were increased by using a camera lucida to mark off each individual as it was counted. Properly identified, simple diagrams made with the camera lucida, on which the position of each chromosome was represented by a short line, were invaluable for the later identification of unmarked negatives or photographs. In each instance in which the structure of a chromosome was partly obscured and it appeared that accurate interpretation of the photograph might be difficult, a careful representation was made on the diagram for the questionable chromosome. This consisted of a line accurately representing the linear dimension across which a short mark was drawn to show the position of the constriction. These diagrams proved very useful during study of the photographs, especially when individual chromosomes were not in perfect focus or when a constriction of one chromosome was partly hidden under an arm of another.

ACKNOWLEDGMENT

Grateful acknowledgment is extended to Dr. Ronald Bamford and Dr. Robert Rappeleye, Department of Botany, University of Maryland, for facilities made available at that institution during this study, and to Texas Research Foundation where the author further developed and refined the technique described here.

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RV #
1 0 0 3 6 3 1 0

NOTES ON SOUTH AMERICAN PHANEROGAMS—III

Lyman B. Smith

The present paper, like the two previous numbers of this series, is mainly the result of revisions that were necessary to name my own collections made in southern Brazil in 1956–57 with the help of a grant from the National Science Foundation. Time does not permit a thorough revision in every case but I feel that a new species is better distinguished by a place in a key than by comparison with a single species to which it may or may not be closely related.

Guttiferae

Hypericum cavernicola L. B. Smith, sp. nov. Fig. 19, a–c.

Suffrutex, verisimiliter parvus, e fragmentis ad 2 dm. longis solum cognitus, glaber, basi ramosus; caulibus erectis vel adscendentibus, ad 7 cm. altis, gracilibus sed lignosis, ramosis, anguste alato-quadrangulatis, maxima ex parte denudatis, internodiis 2–5 mm. longis; foliis liberis, suberectis vel patentibus, ovatis, cordatis, obtuse mucronatis, 6 mm. longis, 3.5 mm. latis, pallide glandulosis, integris, concoloribus, carnosis, anguste cartilagineo-marginatis, uninervatis, nervo supra impresso, subtus prominente; floribus in apicibus ramulorum solitariis vel ternatis, subsessilibus; sepalis inaequalibus, extimis late ellipticis, acutis, 7 mm. longis, 3.5 mm. latis, crassis, multinervatis, intimis anguste lanceolatis, 1 mm. latis; petalis vetustis solum cognitis, asymmetricis, anguste obovatis, 6 mm. longis; staminum phalangibus vix distinctis, quam petalis bene brevioribus, ca. 15-andris; stylis 3, gracilibus, divergentibus, apice capitatis.

Type in the U. S. National Herbarium, no. 2278694, collected at the Gruta de los Cuervos, Department of Tacuarembó, Uruguay, December 17, 1907, by Berro (no. 4862).

Its 3 styles and small 1-nerved leaves place *Hypericum cavernicola* next to *H. denudatum* St.-Hil. in my key to the species of eastern South America (Journ. Washington Acad. Sci. 48, no. 10: 310. 1958). It differs principally in its very unequal sepals, the outer ones being about twice as wide as the inner, where those of *H. denudatum* are uniformly narrow.

Loganiaceae

Spigelia L. Sp. Pl. 149. 1753; Progel in Mart., Fl. Bras. 6, pt. 1: 249. 1868; Solereder, Pflanzenfam. 4, Abt. 2: 32. 1892.

Fig. 19. *a*, *Hypericum cavernicola*, flowering branch; *b*, outer sepal; *c*, inner sepal; *d*, *Spigelia ramosa*, branch; *e*, flower; *f*, *Spigelia Reitzii*, leaf; *g*, fruit; *h*, *Spigelia Kleinii*, leaf; *i*, fruit; *j*, *Spigelia riparia*, branch; *k*, *Spigelia tetraptera*, branch; *l*, *Spigelia bahiana*, apex of plant; *m*, flower; *n*, *Spigelia vestita*, branch; *o*, flower; *p*, *Spigelia australis*, apex of plant; *q*, fruit.

KEY TO THE SPECIES OF EASTERN SOUTH AMERICA

1. Internodes of the stem decreasing slightly and regularly upward, the leaves all opposite, not appearing verticillate, mostly sessile or subsessile with broad bases.
   2. Plant densely glandular; leaves ovate, acute, pilose on both sides and especially on the 5–7 pale nerves beneath.....1. *S. caaguazuensis.*
   2. Plant not conspicuously glandular (stems minutely glandular in *S. linarioides*).
      3. Corolla 18–80 mm. long.
         4. Anthers exserted; plant pubescent.
            5. Stem evenly terete; corolla 30–35 mm. long.....2. *S. Sellowiana.*
            5. Stem sulcate; corolla 20–24 mm. long.....3. *S. pulchella.*
         4. Anthers included.
            6. Tube of the corolla slenderly cylindric; corolla 70–80 mm. long. 4. *S. nicotianiflora.*
            6. Tube of the corolla funnelform; corolla 18–35 mm. long.
               7. Stems herbaceous, often red-striate; corolla 23–30 mm. long; leaves 22–35 mm. long.....5. *S. paraguarensis.*
               7. Stems suffruticose; corolla 18–23 mm. long.
                  8. Sepals 5–6 mm. long; leaves 7–10 mm. long....6. *S. valenzuelana.*
                  8. Sepals 7–10 mm. long; leaves to 40 mm. long....7. *S. epilobioides.*
      3. Corolla not more than 16 mm. long.
         9. Stem distinctly quadrangular (unknown in *S. beccabungoides*).
            10. Leaves ovate or elliptic, rarely more than three times as long as broad.
               11. The leaves 1–3 nerved; spike mostly long-peduncled. 8. *S. Blanchetiana.*
               11. The leaves 5–7 nerved.
                  12. Leaves cordate-clasping at base, not more than 10 mm. long. 9. *S. ramosa.*
                  12. Leaves broad but not cordate at base, 24–35 mm. long.
                     13. Plant pubescent; leaves pinnately nerved, shorter than the internodes.....10. *S. insignis.*
                     13. Plant merely scabrous; leaves palmately nerved, mostly equaling the internodes.
                        14. Sepals with a prominent pale midnerve; corolla 15 mm. long 11. *S. Rojasiana.*
                        14. Sepals even, nerveless; corolla 8–10 mm. long.
                           15. The sepals 6–8 mm. long, exceeding the smooth capsule, conspicuously pale-margined; leaves elliptic..12. *S. Reitzii.*
                           15. The sepals less than 4 mm. long, shorter than the scabrous capsule, nearly concolorous; leaves ovate...13. *S. Kleinii.*
            10. Leaves narrower, lanceolate to linear, much more than three times as long as broad.
               16. The leaves 6–10 cm. long, 1–2.8 cm. wide; sepals 1.5 mm. long; corolla 3.5 mm. long.....14. *S. beccabungoides.*
               16. The leaves smaller; sepals and corolla larger (except in *S. polystachya*).
                  17. Corolla 2 mm. long; inflorescence 20-40-flowered. 15. *S. polystachya.*
                  17. Corolla 5–12 mm. long.
                     18. Sepals 5–6 mm. long.....16. *S. Martiana.*
                     18. Sepals not more than 2.5 mm. long even in fruit.

19. Spikes long-pedunculate; stems strict, 25–50 cm. high. 17. *S. spartioides.*
19. Spikes short-pedunculate or sessile.
20. Corolla 12–14 mm. long. . . . . 18. *S. humilis.*
20. Corolla not over 7 mm. long. . . . . 19. *S. riparia.*

9. Stem terete, even or sulcate (unknown in *S. beccabungoides*).
21. Leaves 50–100 mm. long; plants glabrous.
22. Corolla 3.5 mm. long. . . . . 14. *S. beccabungoides.*
22. Corolla 10 mm. long. . . . . 20. *S. brachystachya.*
21. Leaves 5–37 mm. long.
23. Stems sulcate.
24. Leaves 4 times as long as wide; stems minutely glandular 21. *S. linarioides.*
24. Leaves 10 times as long as wide; stem completely glabrous 22. *S. gracilis.*
23. Stems evenly terete.
25. Leaves 5–7 mm. long; plant fruticulose. . . . . 23. *S. aceifolia.*
25. Leaves 16–37 mm. long; plants stellate-tomentose; spikes pedunculate.
26. The leaves coriaceous, lustrous above. . . . . 24. *S. Lundiana.*
26. The leaves membranaceous, pulverulent-tomentose on both sides. . . . . 25. *S. Olfersiana.*

1. Internodes of the stem abruptly reduced at apex, making the terminal leaves appear verticillate.
27. Stems terete.
28. Spikes several together at the apex of the stem; sepals 1–1.5 mm. long.
29. Terminal 4 leaves very much larger than those below and separated from them by an extra long internode. . . . . 26. *S. anthelmia.*
29. Terminal 4 leaves slightly larger than those next below and separated from them by an internode only a little longer than the others.
30. Leaves 40–50 mm. wide, membranaceous; plant pubescent 27. *S. macrophylla.*
30. Leaves 14–20 mm. wide, subcoriaceous; plant glabrous. 28. *S. glabrata.*
28. Spikes single.
31. Sepals little more than 1 mm. long, shorter than the middle of the capsule; leaves subcoriaceous; spikes few-flowered. . . . . 29. *S. laurina.*
31. Sepals 3–5 mm. long, exceeding the middle of the capsule.
32. Spikes mostly 1-2-flowered. . . . . 30. *S. pusilla.*
32. Spikes 6-many-flowered.
33. Corolla 10 mm. long; spikes sessile. . . . . 20. *S. brachystachya.*
33. Corolla 16–18 mm. long; spikes pedunculate. . . . . 31. *S. laevigata.*
27. Stems quadrangular.
34. Wings of the stem broad and enlarging upward on each internode 32. *S. tetraptera.*
34. Wings of the stem narrow, uniform.
35. Plant completely glabrous.
36. Sepals 6–7 mm. long; flowers solitary, exceeded by the leaves 33. *S. stenophylla.*
36. Sepals 2–5 mm. long; spikes few-many-flowered, equaling or exceeding the leaves.

37. Leaves 10 mm. wide, 30 mm. long, shorter than the internodes; corolla 10 mm. long.....34. *S. intermedia.*
37. Leaves 12–37 mm. wide, 25–75 mm. long.
38. Corolla 18–20 mm. long; leaves petiolate.
39. Leaves strongly bicolorous, dark green above and whitish beneath; sepals 2–3 mm. long.....35. *S. Beyrichiana.*
39. Leaves essentially concolorous; sepals 2 mm. long 36. *S. bahiana.*
38. Corolla 8–14 mm. long.
40. Leaves petiolate, acuminate; sepals barely over 1 mm. long; stems erect.....37. *S. Flemmingiana.*
40. Leaves subsessile, rounded or broadly acute; sepals 4 mm. long; stems often decumbent.....38. *S. scabra.*
35. Plant partially scabrous to pubescent.
41. Sepals 8 mm. long; plant pubescent; leaves subsessile..10. *S. insignis.*
41. Sepals 1–4 mm. long.
42. Spikes long-pedunculate, the peduncles exceeding the leaves 39. *S. Schlechtendaliana.*
42. Spikes short-pedunculate to sessile.
43. Sepals 1–1.5 mm. long.
44. Plant merely scabrous at the nodes and on the petioles; leaves ovate, acuminate.....40. *S. Schomburgkiana.*
44. Plant densely pulverulent-tomentose; leaves oblong-elliptic, subacute.....41. *S. asperifolia.*
43. Sepals 3–4 mm. long.
45. Plant densely glandular-tomentose; leaf-blades not over 17 mm. long.....42. *S. vestita.*
45. Plant scabrous, at least at the nodes; leaf-blades much larger.
46. Leaves elliptic, rounded or broadly acute and often apiculate; plant more or less suffruticose with decumbent stems 38. *S. scabra.*
46. Leaves lanceolate or ovate-lanceolate, acuminate; plant herbaceous with erect stems.....43. *S. australis.*

1. SPIGELIA CAAGUAZUENSIS Kränzl., Rep. Sp. Nov. Fedde 14: 293. 1916.
Paraguay.

2. SPIGELIA SELLOWIANA Cham. & Schlecht., Linnaea 1: 205. 1826.

Spigelia Selloi Spreng. Syst. 4: Cur. Post. 59. 1827.

Brazil: Minas Gerais.

3. SPIGELIA PULCHELLA Mart., Nov. Gen. & Sp. 2: 128, *pl. 194.* 1826.
Brazil: Bahia.

4. SPIGELIA NICOTIANIFLORA Chod. & Hass., Bull. Herb. Boiss. II. 3: 917. 1903.
Paraguay.

4a. Var. CAPIBARENSIS Chod. & Hass., Bull. Herb. Boiss. II. 3: 918. 1903.
Paraguay

4.b Var. PUBERULA Chod. & Hass., Bull. Herb. Boiss. II. 3: 918. 1903. Paraguay.

5. SPIGELIA PARAGUARENSIS Chod., Bull. Herb. Boiss. II. 1: 408. 1901. Paraguay.

5a. Forma SUBSCANDENS Chod. & Hass., Bull. Herb. Boiss. II. 3: 917. 1903. Paraguay.

6. SPIGELIA VALENZUELANA Chod. & Hass., Bull. Herb. Boiss. II. 3: 917. 1903.
Paraguay

6a. Var. MAJOR Chod. & Hass., Bull. Herb. Boiss. II. 3: 917. 1903. Paraguay.

7. SPIGELIA EPILOBIOIDES Kränzl., Bot. Jahrb. 40: 306. 1908. Paraguay.

8. SPIGELIA BLANCHETIANA DC., Prodr. 9: 4. 1845.

Spigelia polita Prog. in Mart., Fl. Bras. 6, pt. 1: 259. 1868.

Brazil: Minas Gerais. The characters which Progel used to distinguish *Spigelia polita* from *S. Blanchetiana* are combined in specimens of *Riedel* 1102 (US).

8a. Var. RIEDELIANA Prog. in Mart., Fl. Bras. 6, pt. 1: 259. 1868.
Brazil: Minas Gerais.

8b. Var. **Hatschbachii** L. B. Smith, var. nov.

Suffruticosa, 16 cm. alta; foliis ovato-lanceolatis, mucronatis, ad 12 mm. longis, 5 mm. latis; spicis longe pedunculatis, pauci- vel submultifloris.

Type in the U. S. National Herbarium, no. 1953016, collected in campo, Eng. Blei, Município of Lapa, Paraná, Brazil, November 28, 1948, by G. Hatschbach (no. 1123). Isotype presumably in Herbário Hatschbach.

Variety *Hatschbachii* combines the long-peduncled spikes of variety *Blanchetiana* and the small leaves of variety *Riedeliana*.

9. **Spigelia ramosa** L. B. Smith, sp. nov. Fig. 19, d–e.

Verisimiliter herbacea, ad 14 cm. alta, valde ramosa; caulibus gracilibus, dense minuteque hispidulis, ultimis quadrangulatis; foliis omnino oppositis, nullo modo verticillatis, sessilibus, late ovatis, acutis, basi cordatis, ad 10 mm. longis, 6 mm. latis, tenuibus, margine pallida paulo revolutis, supra minutissime scabridulis, subtus praesertim ad nervos hispidulis, 5-nervatis, nervis subtus prominentibus pallidisque; spicis terminalibus, pedunculo brevi incluso ad 45 mm. longis, ca. 8-floris; bracteis florigeris anguste lanceolatis, 6 mm. longis, uninervatis, hispidulis; floribus brevissime pedicellatis; sepalis bracteas omnino simulantibus, 5 mm. longis; corolla infundibuliformi, 14 mm. longa, extus glabra, ex sicco rosea, lobis ovatis, 4.5 mm.

longis; staminibus profunde inclusis, antheris ca. 1 mm. longis; capsula late obcordata, 5 mm. lata, glabra.

Type in the U. S. National Herbarium, no. 1134991, collected on loma, north of Cordillera de Altos, Paraguay, October 17, 1902, by K. Fiebrig (no. 283).

10. SPIGELIA INSIGNIS Prog. in Mart., Fl. Bras. 6, pt 1: 259. 1868.
Brazil: Minas Gerais.

11. SPIGELIA ROJASIANA Kränzl., Rep. Sp. Nov. Fedde 14: 292. 1916.
Paraguay.

12. **Spigelia Reitzii** L. B. Smith, sp. nov. Fig. 19, f–g.

Herba fere 5 dm. alta, basi lignosa; caulibus quadrangulatis, ad angulos scabridulis; foliis omnino oppositis, nullo modo verticillatis, subsessilibus, ellipticis vel paucis subovatis, basi apiceque rotundatis, ad 35 mm. longis, 13 mm. latis, coriaceis, margine paulo revolutis, supra atris scaberulisque, subtus pallidioribus glabrisque, basi 5-nervatis, nervis supra impressis, subtus prominentibus; spicis terminalibus, plerumque solitariis, pedunculo 2 cm. long incluso ad 11 cm. longis, subdense 20-floris; rhachi sulcata, scabridula; bracteis florigeris lineari-lanceolatis, acuminatis, quam sepalis paulo brevioribus, haud vel vix nervatis, late pallideque marginatis; floribus subsessilibus; sepalis bracteas omnino simulantibus, 6–8 mm. longis, capsulam superantibus; corolla graciliter infundibuliformi, 11 mm. longa, lobis ovatis, 2 mm. longis; staminibus profunde inclusis, antheris ca. 1 mm. longis; capsula obcordata, 5.5 mm. lata, glabra.

Type in the U. S. National Herbarium, no. 2280008, collected in campo, Fazenda Campo São Vicente, 24 kilometers west of Campo Erê, Município of Chapecó, Santa Catarina, Brazil, altitude 900–1,000 meters, December 27, 1956, by L. B. Smith, R. Reitz and O. Sufridini (no. 9309). Isotypes in Herbário "Barbosa Rodrigues" and Museu Nacional do Rio de Janeiro.

Additional specimens examined:

BRAZIL: *Sellow* (P, F photo 38922, labelled as *S. martiana* Cham.). Santa Catarina: Mun. Xanxerê: In campo, 9 km north of Abelardo Luz, alt. 500–600 m., February 19, 1957, *L. B. Smith & R. Klein* 11443 (HBR, R, US).

13. **Spigelia Kleinii** L. B. Smith, sp. nov. Fig. 19, h–i.

Herba ad 5 dm. alta, basi lignosa; caulibus erectis, paulo ramosis, quadrangulatis, ad nodos scabridulis, alibi glabris; foliis omnino oppositis, nullo modo verticillatis, subsessilibus, ovatis, late subacutis, ad 32 mm. longis, 10–15 mm. latis, coriaceis, margine paulo revolutis, fere concoloribus, supra scaberulis, subtus glabris, basi 5–7-nervatis, nervis supra impressis, subtus prominentibus; spicis terminalibus, solitariis, pedunculo 15–25 mm. longo incluso ad 75 mm. longis, subdense 9–17-floris; rhachi quadrangulata; bracteis florigeris linearibus, acuminatis, 2 mm. longis, quam sepalis multo brevioribus, haud nervatis, anguste obscureque marginatis; floribus sub-

sessilibus; sepalis bracteas omnino simulantibus, 3–3.5 mm. longis, quam capsula subduplo brevioribus; corolla infundibuliformi, 9 mm. longa, lobis ovatis, 2 mm. longis; staminibus inclusis, antheris ca. 1 mm. longis; capsula obcordata, 5 mm. lata, scabra.

Type in the U. S. National Herbarium, no. 2280010, collected in campo, 10 kilometers east of Capão Alto, Município of Lajes, Santa Catarina, Brazil, altitude 900–1,000 meters, February 12, 1957, by L. B. Smith and R. Klein (no. 11336). Isotype in Herbário "Barbosa Rodrigues."

Additional specimens examined:

BRAZIL: Santa Catarina: Mun. Lajes: In campo, Morro Pinheiro Seco, 3 km. east of Lajes, alt. 900–950 m., January 15, 1957, *L. B. Smith & R. Reitz* 10066 (HBR, R, US). Mun Curitibanos: In campo, 5 km. west of Curitibanos on the road to Campos Novos, alt. ca. 850 m., February 9, 1957, *L. B. Smith & R. Klein* 11109 (US).

14. SPIGELIA BECCABUNGOIDES Kränzl., Bot. Jahrb. 40: 307. 1908.
Paraguay.

15. SPIGELIA POLYSTACHYA Kl. in Rich., Schomb. Fauna u. Flora 1082. 1848, nomen; Kl. ex Prog. in Mart., Fl. Bras. 6, pt. 1: 265. 1868.
British Guiana.

16. SPIGELIA MARTIANA Cham., Linnaea 8: 15. 1833.
Brazil: Minas Gerais.

17. SPIGELIA SPARTIOIDES Cham., Linnaea 8: 14. 1833.
Brazil: Minas Gerais.

18. SPIGELIA HUMILIS Benth. in Hook., Journ. Bot. 3: 240. 1841.
British Guiana, Brazil: Amazonas.

19. **Spigelia riparia** L. B. Smith, sp. nov. Fig. 19, j.

Subherbacea, 13–21 cm. alta, ramosa, glabra vel ad nodos et margines foliorum obscurissime scabridulis; caulibus rectis vel tortuosis, gracilibus, quadrangulatis; foliis omnino oppositis, nullo modo verticillatis, linearilanceolatis vel lanceolatis, basi attenuatis subpetiolatisque, apice subacutis, 25–35 mm. longis, 5–10 mm. latis, basi 3-nervatis, nervis supra inconspicuis, subtus prominentibus; spicis plerumque terminalibus, solitariis, sessilibus, 2–5 cm. longis, laxe paucifloris; bracteis florigeris linearibus, 1.5 mm. longis, haud nervatis; pedicellis fructiferis ad 2 mm. longis; sepalis bracteas omnino simulantibus, 2.5 mm. longis, quam capsula subduplo brevioribus; corolla infundibuliformi, 6–7 mm. longa, lobis ovatis, 2 mm. longis; staminibus inclusis, antheris 1 mm. longis; capsula obcordata, 4 mm. lata, glabra.

Type in the U. S. National Herbarium, no. 2280009, collected on rocky bank of Rio Uruguai, Estreito do Uruguai, near Barra do Veado, Município of Concórdia, Santa Catarina, Brazil, altitude ca. 400 meters, January 4,

1957, by L. B. Smith and R. Reitz (no. 9914). Isotypes in Herbário "Barbosa Rodrigues" and Museu Nacional do Rio de Janeiro.

Additional specimens examined:

ARGENTINA: Misiones: "Ad lagunam flum." Posadas, Alto-Paraná, December 9, 1907, *E. L. Ekman* 1375 (US). PARAGUAY: In esteros, Itapé, *Jorgensen* 4507 (US, coarser and with larger broader leaves than those of the type).

20. SPIGELIA BRACHYSTACHYA Prog. in Mart., Fl. Bras. 6, pt. 1: 261, *pl. 68, fig. 3.* 1868.
Brazil: Bahia.

21. SPIGELIA LINARIOIDES DC., Prodr. 9: 6. 1845.
Brazil: Bahia.

22. SPIGELIA GRACILIS DC., Prodr. 9: 6. 1845.
Brazil: Bahia.

23. SPIGELIA ACEIFOLIA Woodson, Ann. Missouri Bot. Gard. 37: 404. 1950.
Brazil: Minas Gerais.

24. SPIGELIA LUNDIANA DC., Prodr. 9: 3. 1845.
Brazil: Minas Gerais.

25. SPIGELIA OLFERSIANA Cham. & Schlecht., Linnaea 1: 206. 1826.

Spigelia pulverulenta Mart., Nov. Gen. & Sp. 2: 126, *pl. 192.* 1826.
Canala heliotropoides Pohl, Pl. Bras. 2: 62, *pl. 142.* 1831.

Brazil: Minas Gerais.

26. SPIGELIA ANTHELMIA L., Sp. Pl. 149. 1753.

Spigelia multispica Steud., Flora 26: 764, 1843.

Tropical America. At this point it is not possible to evaluate the varieties that Progel proposed under the two names above, but it may be that one or more are specifically distinct.

27. SPIGELIA MACROPHYLLA (Pohl) DC., Prodr. 9: 8. 1845.

Canala macrophylla Pohl, Pl. Bras. 2: 64. 1831.
Spigelia glaziovii Taub., Bull. Soc. Bot. France 57, Mem. 3e: 468. 1910. Nomen subnudum.

Brazil: Minas Gerais.

28. SPIGELIA GLABRATA Mart., Nov. Gen. & Sp. 2: 127. 1826.
Brazil: Bahia.

29. SPIGELIA LAURINA Cham. & Schlecht., Linnaea 1: 204. 1826.
Brazil: Bahia or Espírito Santo.

29a. Var. LATIFOLIA Prog. in Mart., Fl. Bras. 6 pt. 1: 264. 1868.
Brazil: Espírito Santo.

30. SPIGELIA PUSILLA Mart., Nov. Gen & Sp. 2: 130. 1826.

Spigelia pauciflora DC., Prodr. 9: 7. 1845.

Brazil: Rio de Janeiro, Santa Catarina.

31. SPIGELIA LAEVIGATA Prog. in Mart., Fl. Bras. 6, pt. 1: 263. 1868.
French Guiana.

32. **Spigelia tetraptera** Taub. emend. L. B. Smith Fig. 19, k.

Spigelia tetraptera Taub., Bull. Soc. Bot. France 57, Mem. 3e: 468. 1910. Nomen subnudum.

Suffruticosa, ramosa, ultra 3 dm. alta, verisimiliter glabra; caulibus quadrangularibus, valde alatis, alis ad apicem internodi versus gradatim latioribus; foliis supremis verticillatis, omnibus distincte petiolatis, ovatis vel lanceolatis, acuminatis, basi rotundatis vel late acutis, ca. 6 cm. longis, 2 cm. latis, subconcoloribus; spicis terminalibus et axillaribus, pedunculo 10 mm. longo incluso ad 7 cm. longis, dense multifloris; bracteis florigeris linearibus, acuminatis, quam sepalis multo brevioribus; floribus distincte pedicellatis; sepalis bracteas omnino simulantibus, ca. 4 mm. longis; corolla graciliter infundibuliformi, ultra 10 mm. longa, rosea; staminibus verisimiliter inclusis.

Type in the Botanisches Museum, Berlin, collected on Morro da Carangola, near Petrópolis, Rio de Janeiro, Brazil, by A. Glaziou (no. 14100). Photograph in Chicago Natural History Museum no. 3929. Isotypes in Paris, Kew, and Geneva, according to Taubert. If, as is probable, the type no longer exists, then the specimen at Paris should become the lectotype.

Additional specimen examined:

BRAZIL: Paraná: Mun. Guaratuba: Stream bank in forest, Garuva, October 10, 1957, *Hatschbach* 4173 (US).

33. SPIGELIA STENOPHYLLA Prog. in Mart., Fl. Bras. 6, pt. 1: 260, *pl. 69, fig. 3*. 1868.
Brazil.

34. SPIGELIA INTERMEDIA Arech., Anal. Mus. Nac. Montevideo II. 1: 60. 1911.
Uruguay.

35. SPIGELIA BEYRICHIANA Cham. & Schlecht., Linnaea 1: 203. 1826.
Brazil: Rio de Janeiro, São Paulo, Paraná.

35a. Var. BREVIFLORA Prog. in Mart., Fl. Bras. 6, pt. 1: 264. 1868.
Brazil.

36. **Spigelia bahiana** L. B. Smith, sp. nov. Fig. 19, l-m.

Herba simplex vel pauciramosa, 15–25 cm. alta, glabra; caulibus quadrangularibus, angustissime alatis; foliis supremis verticillatis, subsessilibus,

infimis oppositis, petiolatis, omnibus ellipticis vel lanceolatis, acuminatis, basi attenuatis, ad 8 cm. longis, 3 cm. latis, subconcoloribus; spicis terminalibus et axillaribus, patentibus, pedunculo gracili 3 cm. longo incluso ad 7 cm. longis, laxe 10–12-floris; bracteis florigeris vix 0.5 mm. longis, anguste triangularibus; floribus sessilibus; sepalis ovatis, acuminatis, 2 mm. longis; corolla graciliter infundibuliformi, 18 mm. longa, ex sicco rosea, lobis ovatis, 3 mm. longis; staminibus inclusis.

Type in the U. S. National Herbarium, no. 704616, collected in forests of Rio Grongogy Basin, Bahia, Brazil, altitude 100–500 meters, October 1–November 30, 1915, by H. M. Curran (no. 209a).

37. SPIGELIA FLEMMINGIANA Cham. & Schlecht., Linnaea 1: 203. 1826.
Brazil: Bahia, Espírito Santo. Although the original description reads: "Caulis teres.", a photograph of the type collection of Sellow (P) shows the stems distinctly quadrangular.

37a. Var. MINOR Prog. in Mart., Fl. Bras. 6, pt. 1: 265. 1868.
British Guiana, Brazil: Bahia.

38. SPIGELIA SCABRA Cham. & Schlecht., Linnaea 1: 202. 1826.

Spigelia Humboldtiana Cham. & Schlect., Linnaea 1: 200. 1826. In part, not as to type.

Southern Brazil, Paraguay, Uruguay. A highly variable species in which I find no well marked subdivisions as yet.

38a. Var. ANGUSTATA Prog. in Mart., Fl. Bras. 6, pt. 1: 261. 1868.
Brazil: Rio de Janeiro. No material seen, position doubtful.

39. SPIGELIA SCHLECHTENDALIANA Mart., Nov. Gen. & Sp. 2: 129. 1826.

Canala rubiaefolia Pohl, Pl. Bras. 2: 65. 1831.
Spigelia rubiaefolia DC., Prodr. 9: 8. 1845.

Brazil: Minas Gerais, Goiás.

40. SPIGELIA SCHOMBURGKIANA Benth. in Hook., Journ. Bot. 3: 240. 1841.
British Guiana. Wrongly assigned to the synonymy of *Spigelia Humboldtiana* by Progel, this species differs in its minute sepals.

41. SPIGELIA ASPERIFOLIA Prog. in Mart., Fl. Bras. 6, pt. 1: 260. 1868.
Brazil: Minas Gerais.

42. **Spigelia vestita** L. B. Smith, sp. nov. Fig. 19, n–o.

Suffruticosa, ramosissima, 25 cm. alta, utrinque dense glanduloso-tomentulosa; caulibus quadrangularibus; foliis supremis verticillatis, omnibus petiolatis, ovatis vel ovato-lanceolatis, ad 17 mm. longis, 7 mm. latis, basi 3-nervatis; spicis terminalibus et axillaribus, erectis, pedunculo 15 mm. longo incluso ad 45 mm. longis, subdense paucifloris; bracteis florigeris anguste triangularibus, ca. 1 mm. longis; floribus pedicellatis; sepalis

anguste triangularibus, 4 mm. longis; corolla graciliter infundibuliformi, ca. 10 mm. longa, lilacina (! Hatschbach), extus pilosa, lobis ovatis, 2 mm. longis; staminibus inclusis; capsula 4 mm. lata.

Type in the U. S. National Herbarium, no. 2279902, collected on bank, at Pien, Município of Rio Negro, Paraná, Brazil, January 15, 1959, by G. Hatschbach (no. 5470). Isotype presumably in Herbário Hatschbach.

43. **Spigelia australis** L. B. Smith, sp. nov. Fig. 19, p–q.

Herba erecta, pauciramosa vel simplex, 2–5 dm. alta, ad nodos petiolosque scabra; caulibus quadrangularibus; foliis supremis verticillatis, subsessilibus, infimis oppositis, petiolatis, omnibus lanceolatis vel ovato-lanceolatis, acuminatis, ad 7 cm. longis, 27 mm. latis, paulo bicoloribus; spicis terminalibus et axillaribus, solitariis, sessilibus, 4–8 cm. longis, basi laxifloris; bracteis florigeris linearibus, ca. 1 mm. longis; floribus brevissime pedicellatis; sepalis ex ovato longe acuminatis, 4 mm. longis, apice recurvatis; corolla graciliter infundibuliformi, ad 18 mm. longa, alba vel ex sicco rosea, lobis ovatis, 2–3 mm. longis; staminibus inclusis; capsula obcordata, 5 mm. lata, glabra.

Type in the U. S. National Herbarium, no. 2280007, collected in pinheiral (*Araucaria* forest), Treinta-tres, 33 kilometers west of Caçador, Município of Caçador, Santa Catarina, Brazil, altitude 900–1000 meters, December 23, 1956, by L. B. Smith and R. Reitz (no. 9104). Isotypes in Herbário "Barbosa Rodrigues" and Museu Nacional do Rio de Janeiro.

Additional specimens examined:

BRAZIL: Rio de Janeiro: Between Monte Serrat and Ponte Maromba, Mt. Itatiaia, Estação Biologica, alt. 800–1200 m., January 1, 1929, *L. B. Smith* 1614 (GH, US). Paraná: Mun. Morretes: Pico Olimpo, alt. 1547 m., January 15, 1950, *Hatschbach* 1755 (US). Santa Catarina: Mun. Dionísio Cerqueira: Tracotinga, 20 km. west of Rio Capetinga on the road to Dionísio Cerqueira, alt. 900–1000 m., December 30, 1956, *L. B. Smith & Reitz* 9634 (HBR, US). Mun. Campo Alegre: Forest, Morro Iquererim, alt. 900 m., October 18, 1957, *Reitz & Klein* 5204 (HBR, US).

It seems unlikely that such a widespread species as *Spigelia australis* has not been noted before, but being unable to connect it with any known species, I am now forced to describe it.

DOUBTFUL AND EXCLUDED SPECIES

No effort has been made to identify the following species beyond trying to be sure that none of them are the same as any of the new species proposed in this paper. With the exception of *Spigelia fruticulosa* Lam., all would appear from their descriptions to be closely related to if not conspecific with *Spigelia scabra* Cham. & Schlecht.

Spigelia chamaedryoides Kränzl., Rep. Sp. Nov Fedde 14: 293. 1916. Argentina.

Spigelia fruticulosa Lam., Illustr. 1: 474. 1793. French Guiana.
The description is inadequate for identification, but the species is probably a synonym of *Spigelia anthelmia* L.

Spigelia guaranitica Chod. & Hass., Bull. Herb. Boiss. II. 3: 917. 1903.
Paraguay.

Spigelia Hassleriana Chod., Bull. Herb. Boiss. II. 1: 407. 1901.
Paraguay.

Spigelia Hassleriana Kränzl., Jahrb. 40: 307. 1908. Non Chod. 1901.
Paraguay.

Spigelia rubelliana Arech., An. Mus. Nac. Montevideo II. 1: 61. 1911.
Uruguay.

Spigelia uruguaya Arech., An. Mus. Nac. Montevideo II. 1: 59. 1911.
Uruguay.

United States National Museum
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Washington, D. C.

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on the epicos: names, types

SOME NOTEWORTHY TREES AND SHRUBS FROM MEXICO

Cyrus Longworth Lundell

LAURACEAE

Beilschmiedia mexicana (Mez) Kostermans, Rec. Trav. Bot. Neerl. 35: 846. 1938.

Hufelandia mexicana Mez, Jahrb. Bot. Gart. Berlin 5: 20. 1889.
Linociera areolata Lundell, Am. Midl. Nat. 23: 176. 1940.

MEXICO: Hidalgo, above Chapulhuacan, in wet *Liquidambar* forest on mountain top, alt. 1300 m., July 12, 1937, *C. L. Lundell & Amelia A. Lundell 7165* (type of *Linociera areolata*, MICH isotype, LL), tree, 6 in. diameter, 30 ft. high, fruits dark blue; same locality (km. 332 of Mexico City highway), July 13, 1943, *C. L. Lundell 12232* (LL), tree, 8 in. diameter, 30 ft. high, fruits black, ellipsoid.

Linociera areolata was based upon a fruiting specimen. In 1943 a visit to the type locality permitted collection of both flowering and fruiting material of the same tree.

RUTACEAE

Amyris lurida Lundell, sp. nov.

Arbor 8-metralis; folia opposita vel subopposita; foliola 3 vel 5, coriacea, elliptica vel ovato-elliptica, 3–7 cm. longa, 1.5–4 cm. lata, apice obtusa, basi rotundata vel late cuneata, crenulata; inflorescentiae cymoso-paniculatae, usque ad 8 cm. longae; flores tetrameri; stamina 8; ovarium pilosum.

Tree, 15 cm. diam., 8 m. high, the branchlets finely pubescent. Leaves opposite or subopposite, leaflets 3 or 5, petioles up to 2.5 cm. long, petiolules of lateral leaflets 3 to 7 mm. long, glabrate, the terminal leaflet with petiolule jointed below base. Leaflets coriaceous, elliptic or ovate-elliptic, 3 to 7 cm. long, 1.5 to 4 cm. wide, apex obtuse, base of lateral leaflets rounded, apical broadly cuneate, margin inconspicuously crenulate, yellowish, much paler beneath, finely pubescent along costa, petiolule, and petiole, glabrate and punctate. Inflorescence terminal and lateral, finely pubescent, cymose-paniculate, up to 8 cm. long, multi-flowered. Flowers 4-merous, finely pubescent, borne on short pedicels usually less than 1 mm. long (in bud). Calyx deciduous early, glandular-punctate, the lobes ovate-triangular, scarcely 0.5 mm. long, ciliate. Petals gland-dotted, suborbicular. Stamens 8, in two series, the shorter opposite the petals. Ovary with elevated glands, pilose, 1-celled with two ovules pendulous from top of cavity.

MEXICO: Sinaloa, in valley, Rancho del Pino, near Chele, May 9, 1943, *C. L. Lundell 13025* (type, LL).

In its caducous calyx and the nature of its indumentum, *A. lurida* resembles *A. madrensis* S. Wats. It is distinguished immediately by its fewer and much larger leaflets.

Amyris mexicana Lundell, sp. nov.

Arbor 5-metralis; folia opposita vel subopposita; foliola 5 vel 7, raro 3, coriacea, rhombico-elliptica vel lanceolata, 2–4.5 cm. longa, 1–2.3 cm. lata, apice obtusa, basi late cuneata, crenulata; inflorescentiae cymoso-paniculatae, usque ad 7 cm. longae; flores tetrameri; stamina 8; ovarium pilosum; fructus globosus, 8–10 mm. diam.

Tree, 5 m. high, twigs, petioles and inflorescence finely pubescent. Leaves opposite or subopposite; leaflets 5 or 7, rarely 3, borne on petiolules 2.5 to 4 mm. long, coriaceous, small, rhombic-elliptic or lanceolate, 2 to 4.5 cm. long, 1 to 2.3 cm. wide, apex obtuse, base broadly cuneate, obtusish, margin crenulate, finely pubescent along the costa, glabrescent otherwise. Inflorescence cymose-paniculate, slender, up to 7 cm. long. Flowers (in bud) borne on short pedicels about 1 mm. long, 4-merous, pubescent. Calyx thick, the lobes shallow, broadly triangular, ciliate. Petals (in bud) gland-dotted medially, pubescent, suborbicular. Stamens 8 in two series. Disk shallow. Ovary with elevated glands, pilose. Fruits globose, 8 to 10 mm. diam.

MEXICO: Michoacan, Coalcoman, at Villa Victoria, alt. 700 m., in woods, May 10, 1939, *Geo. B. Hinton 13763* (type, LL), tree, 5 m., "*arrayan*".

Related to *A. balsamifera* L., it differs in having 5 or 7, rarely 3 leaflets, and globose fruits.

Amyris staminosa Lundell, sp. nov.

Arbor 6-metralis glabra; folia alternata, 3-foliolata, raro 1-foliolata; foliola chartacea, late elliptica vel ovato-elliptica, 3.5–8 cm. longa, 2.5–5 cm. lata, apice rotundata vel obtusa, basi rotundata, crenata; inflorescentiae paniculatae, usque ad 10 cm. longae; flores tetrameri; stamina 8, usque ad 5 mm. longa; ovarium glabrum.

Tree, 6 m. high, glabrous throughout. Leaves alternate, 3-foliolate, sometimes 1-foliolate, the petioles flattened above, with ridges along edges, leaflets chartaceous, drying yellowish, broadly elliptic or ovate-elliptic, 3.5 to 8 cm. long, 2.5 to 5 cm. wide, apex rounded or obtuse, base rounded to obtusish, margins conspicuously double crenate, the petiolules 2 to 3 mm. long. Inflorescence paniculate, axillary and terminal, up to 10 cm. long. Flowers white, sessile, 4-merous. Calyx thick, the lobes broadly rounded, about 0.6 mm. long, much broader than long, the margin hyaline. Petals gland-dotted medially, oblanceolate-elliptic, 2.5 to 3 mm. long. Stamens 8, in two series, the shorter equaling the petals and opposite

them, the longer nearly twice as long as the petals, up to 5 mm. long, slender, conspicuous. Disk prominent. Ovary gland-dotted, ovoid, thick and scarcely tapered above. Stigma capitate.

MEXICO: Michoacan, Coalcoman, at San Jose, alt. 800 m., in woods, June 15, 1939, *Geo. B. Hinton 13800* (type, LL), tree, 6 m., flowers white.

The development of the stamens, with the series alternate with the petals nearly twice the length of the petals, is noteworthy. Although *A. staminosa* appears to be nearest *A. thyrsiflora* Turcz., the leaves differ in being conspicuously double crenate and rounded or obtuse at apex. Also, the flowers are sessile in *A. staminosa*.

Zanthoxylum hidalgense Lundell, sp. nov.

Arbor, 5-metralis; ramulis glabris, armatis; folia usque ad 15 cm. longe petiolata, imparipinnata; foliola 11–15, raro 7–9, opposita, pilosa, lanceolata, 7.5–17 cm. longa, 1.5–6 cm. lata, apice caudato-acuminata, basi cordata, crenulata; petiolulis 1–4 mm. longis; infructescentia glabra, paniculata, compacta, usque ad 12.5 cm. longa; sepala decidua. Follicula glabra, stipitata, ca. 4 mm. longa.

Thorny tree, 7.5 cm. diam., 5 m. high, twigs and petioles often armed with short nearly straight thorns up to 2.5 mm. long, the twigs and inflorescence glabrous, the leaflets short pilose on undersurface, glabrate above except along costa. Leaves large, odd-pinnate, up to 45 cm. long; leaflets usually 11–15, sometimes only 7–9, opposite or the lower subopposite, the apical sometimes much reduced, the blades chartaceous, lanceolate, 7.5–17 cm. long, 1.5–6 cm. wide, apex attenuate and caudate-acuminate, base cordate or subcordate, sometimes inaequilateral, the margin glandular-crenulate to base; the petioles terete, up to 15 cm. long, the petiolules of lateral leaflets 1–4 mm. long; the veins conspicuous. Inflorescence terminal, glabrous, paniculate, up to 12.5 cm. long, congested in fruit. Flowers unknown, the sepals deciduous. Pedicels subequaling fruits. Follicles glabrous, about 4 mm. long.

MEXICO: Hidalgo, km. 296 of Mexico City-Laredo Highway, between Jacala and Chapulhuacan, alt. ca. 6000 ft., July 12, 1943, *C. L. Lundell 12218* (type, LL).

Z. hidalgense has exceptionally large leaves with leaflets cordate at base and tapering into a caudate-acuminate apex, with the blades short pilose beneath, and the margin of the leaflets glandular-crenulate to base. It is related to *Z. mollissimum* (Engler) P. Wilson.

EUPHORBIACEAE

Sebastiania Hintonii Lundell, sp. nov.

Arbor parva, 4-metralis, omnino glabra; folia anguste lanceolata, 6–10 cm. longa, 2–3.2 cm. lata, apice caudato-acuminata, raro obtusa, basi

rotundata, serrulata; petiolus 1–3.5 cm. longus, gracilis; spicae terminales; flores ♀ pedicellati; ovarium glabrum.

Tree, 4 m. high, entirely glabrous, twigs slender; leaves narrowly lanceolate, 6 to 10 cm. long, 2 to 3.2 cm. wide, apex usually caudate-acuminate, sometimes obtuse, base rounded or obtusish, serrulate, lowest teeth of leaves usually glandular; petioles very slender, 1 to 3.5 cm. long, canaliculate above; flowering spikes terminal, up to 5.5 cm. long, the pistillate flowers basal, pedicellate; ovary glabrous.

MEXICO: Guerrero, Galeana, Piedra Ancha-Puerto Hondo, alt. 2100 m., in pine forest, *Geo. B. Hinton 14743* (type, LL).

S. Hintonii has unusually long slender petioles and pedicellate pistillate flowers. Its affinity is with *S. Pavoniana* Muell. Agr.

MYRTACEAE

Eugenia eutenuipes Lundell, sp. nov.

Arbor, ramulis puberulis; folia petiolata, petiolo puberulo, 3.5–7 mm. longo; lamina membranacea, lanceolata vel lanceolato-elliptica, 5.5–9 cm. longa, 2.7–4 cm. lata, apice acuminata, basi acutiuscula; pedicelli fructiferi usque ad 2.8 cm. longi; fructus 8–9 mm. diam.

A tree, twigs slender, flattened at the nodes, persistently puberulent, the leaf buds sericeous with golden brown hairs. Petioles slender, densely and minutely puberulent, 3.5 to 7 mm. long, canaliculate, drying dark reddish brown. Leaf blades membranous, puberulent above along the costa, glabrous otherwise, lanceolate or lanceolate-elliptic, 5.5 to 9 cm. long, 2.7 to 4 cm. wide, apex subabruptly acuminate, the acumen obtuse, base acutish and slightly decurrent, concolorous. Flowers solitary, axillary, usually borne at defoliated nodes. Fruiting pedicels very slender and wiry, up to 2.8 cm. long, very obscurely and finely puberulent. Fruits 1-seeded, obovoid, 8 to 9 mm. in diam. when dry, conspicuously glandular punctate, glabrous, crowned by the persistent calyx, the sepals ciliolate, up to 1.5 mm. long.

MEXICO: Chiapas, Siltepec, January 2, 1937, *E. Matuda 411* (LL, type).

EUGENIA TABASCENSIS Lundell, Phytologia 1: 482. 1941.

MEXICO: Hidalgo, km. 339 of highway, between Chapulhuacan and Tamazunchale, Aug. 19, 1943, *C. L. Lundell & Amelia A. Lundell 12400* (LL, MICH), a shrub, 3 ft. high.

The species, described from Boca Cerro on the Usumacinta River above Tenosique, Tabasco, evidently has close affinity to *E. Karwinskyana* Berg of Hidalgo, known to me only from the original description. In its sepals twice as long, narrower leaves, shorter petioles, and smaller racemes *E. tabascensis* appears distinct.

Eugenia yautepecana Lundell, sp. nov.

Frutex, 4-metralis, ramulis crassis, adpresse rufo-pubescentibus; folia petiolata, petiolo 1.5-2.5 mm. longo; lamina glabra, chartacea, oblongo-elliptica, elliptica vel obovato-elliptica, 2–5 cm. longa, 1.3–2.8 cm. lata, apice late obtusa vel rotundata, basi obtusa vel rotundata; flores breviter racemosi; pedicelli fructiferi 2–3 mm. longi; fructus oblongus, 1–1.3 cm. longus.

Shrub, 4 m. high, twigs and inflorescence pubescent with appressed reddish-brown matted hairs, the internodes short. Leaf blades glabrous, chartaceous, drying greenish-yellow, oblong-elliptic, elliptic or obovate-elliptic, 2 to 5 cm. long, 1.3 to 2.8 cm. wide, apex broadly obtuse or rounded, base obtuse or rounded, primary lateral veins 6 to 8 pairs, the secondary venation reticulate; petioles 1.5 to 2.5 mm. long, rather stout, evidently appressed pubescent at first. Inflorescence axillary, few-flowered, short racemose, the racemes stout, subequaling petioles, not over 3 mm. long. Fruiting pedicels stout, 2 to 3 mm. long, appressed pubescent. Fruits oblong, 1 to 1.3 cm. long, red-blushed when ripe, crowned by the persistent calyx lobes, the lobes rounded, up to 3 mm. wide, pubescent with appressed reddish-brown hairs.

MEXICO: Morelos, km. 15 of highway, on lava field, Yautepec-Cuernavaca Road, Oct. 2, 1943, *C. L. Lundell & Amelia A. Lundell 12502* (type, LL).

E. yautepecana is related to *E. inconspicua* Standl. of Sinaloa.

OLEACEAE

Fraxinus reflexiflora Lundell, sp. nov.

Frutex vel arbor parva, novella stellato-tomentosa; folia novella lepidota, petiolata; foliola 9–13, raro 3–7, lanceolata, ovato-elliptica vel elliptica, 1–2 cm. longa, 0.5–1 cm. lata, apice acuta, basi acutiuscula, serrata; infructescentiae reflexiflorae, paniculatae, usque ad 3.5 cm. longae; pedicelli fructiferi 2–4 mm. longi; fructus 9–11 mm. longus, emarginatus.

Shrub or low tree; twigs, petioles and inflorescence finely tomentose at first with stellate hairs. Leaflets usually 9–13, sometimes only 3–7, lepidote at first, essentially glabrous at maturity, the petiole and leaf rachis narrowly winged, lanceolate, ovate-elliptic or elliptic, 1 to 2 cm. long, 0.5 to 1 cm. wide, apex acute, subsessile and acutish at base, inaequilateral, sharply serrate. Inflorescence paniculate, the panicles reflexed, up to 3.5 cm. long, slender. Pedicels slender, 2 to 4 mm. long. Samaras small, with persistent cupulate calyx at base, 9 to 11 mm. long, the wing emarginate, longer than the thick subterete body, the seed about 4 mm. long.

MEXICO: Durango, Corral de Piedra, alt. 4000 ft., April 10, 1943, *C. L. Lundell 13005* (type, LL), "*venadillo*".

Related to *F. Purpusii* T. S. Brandeg., *F. reflexiflora* differs from that species in being tomentose and in having samaras scarcely half as large. The samaras are the smallest in the genus.

A FERN NEW TO THE UNITED STATES

Donovan S. Correll

Although some of the caves and sink-holes that occur in Texas, especially on the Edwards Plateau, have received some attention from botanists, there are innumerable others that have never been investigated. Indeed, a nice piece of research could be produced on the flora of such places by a speleological botanist. The need for such exploration has recently been further emphasized by the finding of the tropical American fern, *Dennstaedtia globulifera* (Fig. 20) in a cave in Val Verde County, Texas. This species is not only new to Texas but also to the United States.[1]

The finding of *Dennstaedtia globulifera* adds a new genus of ferns to the flora of Texas and brings the number of species of pteridophytes known to occur there to 109. For convenience in identifying the species, not only an illustration is included but a description[2] is given below.

Dennstaedtia globulifera (Poir.) Hieron., Bot. Jahrb. Engler 34: 455. 1904.

Polypodium globuliferum Poir. in Lam., Encycl. 5: 554. 1804.

Rhizome slender or stout, creeping, densely hairy; stipes rather stout, up to 1 m. or more long, bright yellowish brown, lustrous, finely puberulous, glabrous with age; blades ample, deltoid, 1–3 m. long and broad, coarsely 3-pinnate, the tertiary divisions crenately lobed or parted; basal pinnae petiolate, subovate, acuminate, 0.6–1 m. long, 2.5–4 dm. broad, the rachis yellowish brown, obtusely ridged above, beset with brownish septate hairs, glabrescent and scabrous beneath; secondary pinnae laxly spreading, linear-oblong to subdeltoid-oblong, petiolate, long-acuminate, the larger ones 8–20 cm. long and 3–6 cm. wide; pinnules subdistant, laxly spreading, 1.5–3.5 cm. long, 7–15 mm. wide, obliquely oblong to ovate-oblong, subauriculate, subacute or mostly broadly obtuse at apex, essentially sessile or the middle and outer ones deeply constricted and joined by a broadening foliaceous wing; larger lobules or ultimate segments in 4 or 5 pairs, poorly developed or prominently trapezio-ovate to elliptic-oblong, broadly obtuse to subtruncate at apex, lightly and broadly dentate, monosorous at distal sinus; veins pinnately branched and strongly elevated on lower surface; leaf-tissue soft-herbaceous, yellowish green, glabrous on upper surface, more or less pubescent on lower surface with spreading yellowish brown

[1] I wish to acknowledge the help of Mr. C. V. Morton in identifying this plant, and my appreciation to Dr. B. L. Turner for calling my attention to its discovery.

[2] Adapted in part from Maxon in Scientific Survey of Porto Rico and the Virgin Islands 6(3): 492. 1926.

Fig. 20 *Dennstaedtia globulifera* (Poir.) Hieron.: 1, pinnule, showing sori, about × 3; 2, sorus, × 20; 3, two pairs of secondary pinnae, × 2/3. Illustrated by Phoebejane Horning.

hairs; sori numerous, marginal, solitary in sinuses, terminating the veins, globose, mostly 1.2–1.5 mm. thick, the soral pouch deeply cyathiform; indusia extrorse, convex, adnate to the lateral margins of a subequal similarly modified concave usually recurved leaf-lobule, shallowly valvate.

TEXAS: Val Verde County, Fern Cave, 18 miles north of Comstock, growing in cave on the Martin J. Rose, Jr. Ranch, fronds up to 13 ft. long, cave about 50 ft. deep, Nov. 2, 1958, *Larry Hoffman s. n.* (TEX).

Dennstaedtia globulifera is now known to occur throughout the West Indies and from northern South America northward in the tropical and subtropical regions of Central America and Mexico, with a disjunct station in Val Verde County, Texas. It is usually found in moist thickets and partially shaded places.

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WRIGHTIA

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PLANTAE MAYANAE—II

COLLECTIONS FROM PETEN AND BELICE

CYRUS LONGWORTH LUNDELL

Exploration of the lowlands of Guatemala during 1960 was centered in northern Peten, chiefly in the Tikal National Park and around the eastern end of Lake Peten. The work was greatly facilitated by the staff of the Tikal Project of the University of Pennsylvania Museum, and by Mr. Jorge Ibarra, Director of the Museo Nacional de Historia Natural of Guatemala. The investigations were continued under a grant from The Rockefeller Foundation for an "evaluation of the ancient agriculture of the lowland Maya area of Guatemala".

Numerous additions to the flora, and some species and genera, apparently undescribed, are represented in the accumulated collections. Noteworthy among these is a striking new genus in the Sapindaceae, which I have named *Tikalia*, commemorating the metropolis of the ancient Maya. This large tree is a conspicuous element in the upland forest (*ramonal*) at Tikal.

In the exploration of their petroleum concession in northern Peten, which encompasses the area in which the Tikal National Park is located, an Esso Standard geological party encountered a small pineland area in the great swamp, Bajo de Santa Fe. This was indicated as situated on *Brecha* "J" *Petrolera*, an east-west survey line which crosses the swamp to the northeast of Tikal. Since no pineland (*pinal*) had been known previously to exist in northern Peten, and a study of such an isolated association would be of interest botanically, a party under the leadership of my field assistant, Elias Contreras, opened a trail into the area.

Shortly after my arrival at Tikal on February 22, 1960, an aerial reconnaissance at the Bajo de Santa Fe was made to locate more accurately the pine area and the extent of the pine stands. Setting a course of 77° from Tikal the pineland was discovered to be about ten miles ENE of Tikal, along the northern limits of the Tikal National Park. The principal stand forms a kettle-shaped hammock covering not over two square kilometers with an island of upland forest (*ramonal*) located to its north at the base of the "kettle". Another much smaller stand was noted to the East, the pines towering conspicuously above the low swamp forest.

On March 6 a muleback trip from Tikal was made to explore the pineland (*pinal*), and three days were spent in the area. Camp was set up on a ruin covered island of upland forest (*ramonal*) several miles west of the *pinal*. This island was named Isla de Los Pavos. Progressing eastward along

Brecha "J" *Petrolera*, the upland forest gives way abruptly to swamp forest dominated by the logwood (*tinta*), *Haematoxylon campechianum* L., and the typical knarled low forest of the *tintal* association. An *aguada* in the heart of this *tintal* was named Aguada Lagarto, after its inhabitants. Progressing eastward the *tintal* association gives way to the *hololal*, in which the "*holol*" tree, *Quercus oleoides* Schlecht. & Cham., dominates, and in which the "*tasiste*" palm, *Paurotis psilocalyx* (Burret) Lundell, is a characteristic element. Progressing through the *hololal* association, an area is reached in which tall scattered pines grow, and this is the *pinal* proper (see figs. 21 and 22). Aside from the pines, some of which reach a diameter of over two feet and a height of some eighty feet, the *pinal* association floristically is almost identical to that of the *hololal* with species of *Paurotis*, *Myrica*, *Quercus*, *Ateleia*, *Byrsonima*, *Croton*, *Sebastiania*, *Ilex*, *Eugenia*, *Rapanea*, and *Cameraria* forming the open canopy of low, mostly knarled trees, less than thirty feet in height. Below in the undergrowth *Psychotria fruticetorum* Standl., and two melastomes, *Clidemia neglecta* D. Don and *Miconia ciliata* (Rich.) DC., are conspicuous. Open areas are very limited, and in these

FIG. 21. The *pinal* of Bajo de Santa Fe, with Elias Contreras standing in foreground. Note size of trunk of the pine, *Pinus caribaea* Mor., in the center background. The palm is *Paurotis psilocalyx* (Burret) Lundell. The small slender trees and shrubs are typical of the *pinal*, *hololal* and *tintal* associations.

FIG. 22. A towering pine, *Pinus caribaea* Mor., in the *pinal* of Bajo de Santa Fe. These trees are scattered through the low swampy hammock.

and in open undergrowth, the tussock forming sedge, *Rhynchospora cephalotes* (L.) Vahl dominates. Over much of the *hololal* and *pinal*, an impenetrable cover is formed by the "saw-grass" *Scleria bracteata* Cav.

The *pinal* of the Bajo de Santa Fe has essentially the same floristic composition and general appearance as the hammocks in the pinelands of northern British Honduras and the everglades of southern Florida. Two related species of *Pinus* and *Paurotis* characterize both.

Although the *pinal* association of Bajo de Santa Fe is distinctive, it is not particularly rich in species, so there will not be a substantial number of additions to the flora of northern Peten. The Melastomaceae, notable by their scarcity in other associations, are conspicuous here although only three species have been collected. The herbs, mostly grasses and sedges, are typical pineland species.

The *pinal* was of possible importance to the ancient Maya as a local source of torch wood, for pine torches were used extensively.

All collections in the *pinal*, and its marginal *hololal* association, are included in the following list. Of the seventy-eight species recorded, fifty-six are new records for northern Peten (see Lundell, *The Vegetation of Peten*, Carnegie Inst. Publ. 478: 49–81. 1937). These are indicated by an asterisk.

LARGE AND MEDIUM SIZED TREES:

Pinaceae	* *Pinus caribaea* Mor.
Palmae	* *Paurotis psilocalyx* (Burret) Lundell.
Fagaceae	*Quercus oleoides* Schlecht. & Cham.
Leguminosae	* *Ateleia cubensis* Griseb.
	Haematoxylon campechianum L.
Aquifoliaceae	* *Ilex guianensis* (Aubl.) Kuntze.
Myrtaceae	* *Eugenia Winzerlingii* Standl.

SMALL TREES AND SHRUBS:

Myricaceae	* *Myrica cerifera* L.
Leguminosae	*Calliandra emarginata* (Humb. & Bonpl.) Benth.
Erythroxylaceae	* *Erythroxylon brevipes* DC.
Malpighiaceae	* *Byrsonima bucidaefolia* Standl.
	Byrsonima crassifolia (L.) H.B.K.
	* *Heteropteris Lindeniana* Juss.
Euphorbiaceae	* *Croton jutiapensis* Croizat.
	Croton reflexifolius H.B.K.
	Sebastiania adenophora Pax & Hoffm.
Aquifoliaceae	* *Ilex guianensis* (Aubl.) Kuntze.
Sapindaceae	* *Allophylus Cominia* (L.) Swartz.
Bombacaceae	* *Hampea trilobata* Standl.
Flacourtiaceae	* *Xylosma anisophylla* Standl.
Myrtaceae	* *Calyptranthes Karlingii* Standl.
	* *Eugenia Fadyenii* Krug & Urban.
	Eugenia Lundellii Standl.
Melastomaceae	* *Clidemia neglecta* D. Don.
	* *Clidemia rubra* (Aubl.) Mart.
	* *Miconia ciliata* (Rich.) DC.
Myrsinaceae	*Parathesis cubana* (A.DC.) Mol. & Maza.
	* *Rapanea guianensis* Aubl.
Ebenaceae	* *Diospyros bumelioides* Standl.
Sapotaceae	*Achras Zapota* L.
	Bumelia mayana Standl.
Apocynaceae	* *Cameraria latifolia* L.
	* *Plumeria obtusa* L. var. *sericifolia* (Wright) Woodson.
Rubiaceae	* *Machaonia Lindeniana* Baill.
	Psychotria fruticetorum Standl.
	* *Randia aculeata* L.

LIANAS, CLAMBERING PLANTS AND VINES:

Dioscoreaceae	* *Dioscorea* sp. (*Lundell 16741*).
Polygalaceae	* *Bredemeyera lucida* (Benth.) Benn.
Asclepiadaceae	* *Metastelma barbigerum* Scheele.

Rubiaceae	*Chiococca alba* (L.) Hitchc.
Compositae	*Perymenium Peckii* Rob.
	* *Vernonia* sp. (*Lundell 16718*).

HERBS:

Gramineae	* *Panicum* sp.
	* *Panicum* sp.
Cyperaceae	* *Fuirena bulbipes* Blake.
	Rhynchospora cephalotes (L.) Vahl.
	Rhynchospora cyperoides (Swartz) Mart.
	* *Rhynchospora fascicularis* (Michx.) Vahl.
	* *Rhynchospora* sp. (*Contreras 525*).
	* *Rhynchospora* sp. (*Contreras 527*).
	Scleria bracteata Cav.
Iridaceae	* *Cipura paludosa* Aubl.
Oxalidaceae	* *Oxalis Neaei* DC.
Ochnaceae	* *Sauvagesia erecta* L.
Turneraceae	* *Turnera ulmifolia* L.
Gentianaceae	* *Coutoubea spicata* Aubl.
Verbenaceae	* *Ghinia spicata* (Aubl.) Moldenke.
Rubiaceae	* *Borreria* sp. (*Contreras 524*).
	* *Coccocypselum hirsutum* Bartl.
Compositae	*Wedelia parviceps* Blake.

EPIPHYTES:

Polypodiaceae	*Polypodium plumula* H. & B.
Bromeliaceae	* *Catopsis Morreniana* Mez.
	* *Catopsis sessiliflora* (R. & P.) Mez.
	Tillandsia bulbosa Hook.
	* *Tillandsia circinnata* Schlecht.
	* *Tillandsia dasyliriifolia* Baker.
	* *Tillandsia festucoides* Brongn. ex Mez.
	* *Tillandsia streptophylla* Scheidw.
Orchidaceae	* *Epidendrum diffusum* Sw.
	* *Epidendrum nocturnum* Jacq.
	* *Epidendrum radiatum* Lindl.
	* *Epidendrum* sp. (*Contreras 549*).
	* *Laelia Digbyana* Benth.
	Maxillaria uncata Lindl.
	* *Polystachya clavata* Lindl.
	Trigonidium Egertonianum Batem. ex Lindl.

PARASITIC PLANTS:

Loranthaceae	* *Struthanthus cassythoides* Millsp.
Lauraceae	*Cassytha filiformis* L.

The presence of a pine studded hammock in a logwood swamp is unusual, and soil samples were taken from the *pinal* and these are compared with soil samples from the *tintal* of Bajo de Santa Fe near Aguada Pucte at Tikal. A report on these has been prepared by Dr. W. Derby Laws and published herewith (Wrightia 2: 127–132. 1961). He concludes (l.c., p. 132) that there is little difference chemically in the soil from the *tintal* and from the *pinal*, but that the *pinal* soil is lower in clay content and higher in sand content. Also, the organic matter in the top twelve inches of soil from the *pinal* was more carbonaceous than organic matter from soil of the same depth in the *tintal*.

The Bajo de Sante Fe is a subsidence basin of Eocene limestone in which the heavy clay soils are of great depth, evidently accumulated from erosion of the agricultural uplands. The very low phosphorus content of these soils is of possible significance.

The *pinal* is a peculiar local edaphic area worthy of further investigation geologically and ecologically.

In addition to materials reported on from Peten, notable additions to the flora are described from the rich collections of Percy H. Gentle in Belice.

PALMAE

Paurotis psilocalyx (Burret) Lundell, comb. nov.

Brahea psilocalyx Burret, Notizbl. Bot. Gart. Berlin 11: 1037. 1934.

Acoelorraphe pinetorum Bartlett, Carnegie Inst. Publ. 461: 33. 1935.

GUATEMALA: Department of Peten, Tikal National Park, Bajo de Santa Fe, in *pinal*, March 7, 1960, *C. L. Lundell 16715* (LL), plants up to 25 ft. high; flowers yellow, scented.

MORACEAE

Ficus Gentlei Lundell, sp. nov.

Arbor grandis, omnino glabra; stipulae usque ad 1.5 cm. longae, acuminatae, caducae; folia chartacea, longe petiolata, petiolo 3.5–9 cm. longo; lamina obovata, obovato-elliptica vel elliptica, 9.5–17 cm. longa, 4.5–9 cm. lata, apice abrupte acuminata, basi late cuneata vel obtusa vel rotundata; receptacula axillaria, geminata, pedunculis 3–5 mm. longis; involucrum bilobum, 5 mm. diam.; receptacula obovoidea, 9–10 mm. diam.; ostiolo prominente.

A large tree, entirely glabrous, the twigs pallid. Stipules red-brown, caducous early, lanceolate, attenuate to the long slender acuminate apex, up to 1.5 cm. long. Leaves chartaceous, long-petiolate, the petioles canaliculate, 3.5 to 9 cm. long; leaf blades obovate, obovate-elliptic, or elliptic, 9.5 to 17 cm. long, 4.5 to 9 cm. wide, apex rather abruptly short acuminate, base broadly cuneate, or sometimes rounded and obtuse, or rounded, primary veins 8 to 12, widely ascending, the reticulation fine but conspicu-

ous. Receptacles axillary, geminate, with short peduncles 3 to 5 mm. long. Involucre 2-lobed, spreading, glabrous, about 5 mm. in diam., the lobes rounded. Receptacle obovoid, strongly depressed, 9 to 10 mm. in diam., glabrous, spotted. Ostiole large, distinctive, slightly depressed, crateriform, 3 to 3.5 mm. in diam., with a distinctive ridge surrounding it, closed by three scales.

BRITISH HONDURAS: Toledo District, Rio Grande, in high ridge on river bank, Aug. 4, 1944, *Percy H. Gentle 4739* (type, LL), large tree.

The collection was distributed as *Ficus Hemsleyana* Standl. which is a synonym of *F. citrifolia* P. Mill. Its relationship is to this species, but differs conspicuously in having predominantly obovate leaves mostly cuneate at base. The large slightly depressed ostiole, 3 to 3.5 mm. wide with marginal ridge, and the short peduncles distinguish it further.

POLYGONACEAE

Coccoloba hirtella Lundell, sp. nov.

Arbor, ramuli hirtelli; ocreis chartaceis, truncatis; petiolis ad basem ocreis gerentibus, 2–3.5 cm. longis; lamina bullata, hirtella, chartacea, oblonga, oblongo-elliptica, vel obovato-elliptica, 12.5–25 cm. longa, 9–16 cm. lata, apice obtuse apiculata, basi emarginata vel cordata; inflorescentiae paniculatae; floribus ignotis; pedicelli fructiferi ad 2.5 mm. longi; fructu ovoideo basi rotundato, 8–10 mm. diam., lobis perianthii ovatis, imbricatis.

A large tree, twigs thick, drying striate, densely pubescent with short rigid hairs of unequal length. Ocrea truncate, chartaceous, hirtellous, dark brown. Petioles arising at base of ocrea, thick, striate, 2 to 3.5 cm. long. Leaf blades bullate, firmly chartaceous, hirtellous on both surfaces, densely so beneath, oblong, oblong-elliptic, or obovate-elliptic, 12.5 to 25 cm. long, 9 to 16 cm. wide, apex obtusely apiculate, base emarginate to deeply cordate, lateral veins 8 to 11, impressed on upper surface, prominent beneath, secondary veins conspicuously reticulate and elevated on lower surface, impressed above. Inflorescence paniculate, densely puberulent, the branches thick, striate. Flowers unknown, the bracts and ocreolae puberulent, small, less than 1 mm. long. Fruiting pedicels crowded, stout, up to 2.5 mm. long, glabrate. Fruits ovoid, rounded at base, 8 to 10 mm. diam., slightly longer than wide, the perianth lobes broadly ovate, imbricate, puberulent.

BRITISH HONDURAS: Toledo District, near San Antonio, in high ridge near base of hill, Nov. 19, 1945, *Percy H. Gentle 5427* (type, LL), *"wild grape"*.

C. hirtella is related to *C. belizensis* Standl., but differs at once in its bullate more deeply cordate chartaceous leaves, and in its much larger fruits. In *C. belizensis* the ripe fruits are ellipsoid, up to 7 mm. long and 6 mm. in diam. (*Gentle 4902*). In *C. hirtella* the fruits of the type are immature, yet fully twice as large and ovoid.

C. hirsuta Standl., described from sterile material with "copious long

pubescence of the leaves", has been reduced to synonymy under *C. belizensis* (Jour. Arnold Arb. 40: 191. 1959), but collection of fertile material from the type locality is necessary to settle this question. *C. hirtella* may have affinity to the species, but its hirtellous indumentum and bullate leaves appear to distinguish it on the basis of material now available.

COCCOLOBA LUNDELLII Standl., Publ. Field Mus. Bot. 8: 138. 1930.

BRITISH HONDURAS: Orange Walk District, Honey Camp, October 24, 1929, *C. L. Lundell 649* (type, F).

Evidently closely related to *C. uvifera* L., *C. Lundellii* has very similar edible fruits. The type was collected from plants growing at the water's edge around the larger island of the Honey Camp Lagoon. Here the plants form a continuous thicket up to thirty feet high, with the crowns overhanging the water. In October the branches are so weighted down with full racemes of the deep purple fruits that they dip into the lagoon. Although the pulp is scant, it is tasty.

COCCOLOBA TUERCKHEIMII Donnell Smith, Bot. Gaz. 37: 213. 1904.

BRITISH HONDURAS: Toledo District, Bolo Camp, upper reach of Golden Stream, in high ridge, April 5, 1944, *Percy H. Gentle 4496* (LL), tree, "*wild grape*".

This collection is anomalous in that the leaf blades are bullate, obtuse at apex, and the fruits are globose and rounded at base, not stalked, and fully 1 cm. in diameter at maturity. I have seen no other material of the species, or of *C. latifolia* Lam. to which it is compared by Howard (Jour. Arnold Arb. 40: 216. 1959). If I interpret Howard correctly, bullate leaf blades are characteristic of *C. latifolia*. Further material is needed to clarify the position of *C. Tuerckheimii*.

The species has not been recorded previously from Belice.

SAPINDACEAE

Cupania mayana Lundell, nom. nov.

Matayba retusa Lundell, Lloydia 4: 52–53. 1941, non *Cupania retusa* Klotzsch, 1848.

MEXICO: Tabasco, in second growth at Tenosique, June 14–16, 1939, *Eizi Matuda 3403* (isotype, LL), small tree. GUATEMALA: Department of Alta Verapaz, along Rio Sebol, to junction with Rio Santa Isabel, alt. 125–150 m., April 20, 1942, *Julian A. Steyermark 45811* (LL), tree, 35 ft. tall, leaves subcoriaceous or firmly membranous, deep grass green above, dull paler green beneath, fruit spongy or bladdery, pale green. Department of Peten, San Luis, along road south, between kilometers 51–52, edge of town, July 10, 1959, *C. L. Lundell 16265* (LL), tree, 8 in. diam., 30 ft. high, ripe fruits orange-red, "*dzopolte*".

It is evident from the additional collections now available that the species is referable to *Cupania*, where it appears to belong in the Section

Tricoccocarpus Radlk., with affinity to *C. macrophylla* A. Rich. The sepals twice as large, and the smaller thin-walled fruits, 3-lobed almost to the base, immediately distinguish it from the latter. The leaflets are rounded and retuse, whereas they are predominantly obtuse in *C. macrophylla*.

Tikalia Lundell, gen. nov. Fig. 23.

Arbor exstipulata; folia longe petiolata, foliolo terminali semper deficiente abrupte pinnata; foliola 4–10, plerumque 6, alternantia vel subopposita, oblongo-lanceolata, basi acutiuscula, apice acuminata, integra, pinnatinervia, subtus in nervorum axillis barbata; paniculae ad apices ramorum axillares; flores polygami, regulares, mediocres; sepala 5, libera, ovato-lanceolata, apice novella imbricata, persistentia, pubescentia; petala 2-squamulata, plerumque rudimentaria vel nulla; discus regularis, annuliformis, glaber; stamina 5, raro 4 vel 6, uniseriata, glabra, exserta; filamenta filiformia, longa, glabra; antherae glabrae, supra basin emarginatum affixae; ovarium 1-loculare; capsula oblonga, glabra, styli residuis apiculata, loculicide 1-valvis, monosperma; semina ellipsoidea.

Referable to the Cupanieae, *Tikalia* evidently has affinity to *Cupania*. From that genus it differs notably in having essentially valvate sepals, 5 (4–6) stamens, and a loculicidal 1-valved capsule. In *Cupania* there are 8 stamens and the sepals are imbricate in two series. Furthermore, *Cupania* has a cupulate aril which is not present in *Tikalia*, and loculicidal 3- (2–4-) valved capsules. It is probable that the ovary of *Tikalia* is 1-celled by abortion, but no vestiges of the other cells are present in the fruiting material available. The pistillate flowers are unknown.

Tikalia prisca (Standl.) Lundell, comb. nov. Fig. 23.

Cupania prisca Standl., Carnegie Inst. Publ. 461: 69. 1935.

A large tree with low buttresses and white bark, up to 25 m. high, 60 cm. diam., abundant in the *ramonal* and *zapotal*. Branchlets slender, fulvous, densely and finely pubescent, drying angulate. Petioles, petiolules, and inflorescence puberulent. Leaves 4- to 10-, usually 6-foliolate, the petioles slender, 2.5 to 7 cm. long; leaflets borne on short petiolules 2 to 3 mm. long, rarely longer, leaf blades thin, concolorous, oblong-lanceolate, usually 6 to 13 cm. long, sometimes smaller, 2 to 4.5 cm. wide, base inaequilateral, acutish, apex acuminate, puberulent along the costa and leaf margins, barbate beneath in the axils of the primary veins, the margin essentially entire, primary veins slender but conspicuous, 7 to 11 on each side. Flowers regular, polygamous. Staminate inflorescence axillary, laxly paniculate, slender and remotely branched, up to 14 cm. long, usually smaller. Staminate flowers borne on pedicels up to 3 mm. long at anthesis, accrescent, jointed below the middle; calyx 1.5 to 2 mm. long at anthesis, the sepals imbricate apically in bud, valvate below, free, usually 5, sometimes 4 or 6, finely pubescent on both surfaces, ovate-lanceolate, acute. Petals, when fully developed, ovate-oblong, subequaling sepals, with two

FIG. 23. *Tikalia prisca* (Standl.) Lundell: A, branch with staminate inflorescences; B, branches with fruits; C, fruit; and D, embryo. Illustrated by Phoebejane Horning.

hairy scales at base within, these united into the short stipe; the petals usually rudimentary, sometimes none. Disk large, fleshy, glabrous. Stamens 5 in a single series, sometimes 4 or 6, borne on the disk, entirely glabrous, conspicuously exserted at anthesis; filaments accrescent, up to 5 mm. long

at anthesis; anthers oblong or ovate-oblong, 1 to 1.2 mm. long, cordate at base, rounded or subtruncate at apex, longitudinally dehiscent; abortive ovary hairy at apex. Fruiting pedicels stout, 3 to 7 mm. long, jointed below the middle, the persistent calyx up to 2.5 mm. long, the sepals unequal, 5 (sometimes 4 or 6), free to base, lanceolate or linear-oblong, up to 2.2 mm. long, acute, puberulent on both surfaces. Ovary glabrous, strongly asymmetrical, 1-celled (by abortion?), with one axillary ovule. Style of fruits recurved, stout, bearing a conspicuous lateral acute stigma. Fruits oblong, asymmetrical, loculicidally dehiscent, smooth, red when ripe, 1-celled, 1-seeded, 1.5 to 2 cm. long, crowned by the persistent lateral style. Seeds ellipsoid, the seed coat fleshy. Embryo oblong, sharply segmented.

GUATEMALA: Department of Peten, Tikal, in *ramonal*, January 31, 1959, *C. L. Lundell 15268* (LL), tree, 8 in. diam., 35 ft. high, staminate flowers pinkish, "*tzol*"; same locality, February 10, 1959, *Lundell 15471* (LL), tree with low buttresses, 12 in. diam., 80 ft. high, fruits red, "*tzol*"; same locality, April 30, 1959, *Lundell 15935* (LL), tree, 14 in. diam., 40 ft. high, "*tzol*"; Remate, on Tikal Road, about 13 km. northeast of village, in *zapotal*, May 14, 1960, *Elias Contreras 939* (LL), tree, 30 ft. high, 5 in. diam., fruits reddish, "*tzol*".

This is one of the characteristic and most abundant trees in the *ramonal* covering the ruins of Tikal, the ancient Maya city which the name commemorates.

The type of *Cupania prisca* Standl. was collected at nearby Uaxactun.

BOMBACACEAE

QUARARIBEA YUNCKERI Standl., Publ. Field Mus. Bot. 9: 306–307. 1940.

HONDURAS: Department of Atlantida, river bank, foothills back of La Ceiba, June 25, 1938, *T. G. Yuncker, J. M. Koepper & K. A. Wagner 8010* (isotype, DPU), tree, about 40 ft. tall and 18 in. diam., flowers fleshy, white, abundant. BRITISH HONDURAS: Toledo District, Edward's Road beyond Columbia, in high ridge at base of hill, October 29, 1947, *Percy H. Gentle 6308* (LL), tree, 12 in. diam., bark dark, wood brown, hard, "*black oak*".

Through the courtesy of Dr. T. G. Yuncker, I have compared the isotype with the Gentle collection. In the fruiting material of the latter, the leaves are much firmer, essentially trinerved at base, with the lateral veins conspicuously coalescing with the midveins. In these aspects the specimens from Belice differ somewhat, but these differences are due probably to maturity.

The thick fruiting pedicels are 5 to 7 mm. long, usually curved. The indurated fruiting calyx is cupulate, 5 to 7 mm. deep, 12 to 15 mm. wide. Evidently the calyx lobes have fallen, for the margin is irregular. The fruits are obovoid-ellipsoid, somewhat depressed, up to 1.7 cm. long, 1.8 cm. in diameter, 2-celled and 2-seeded.

LECYTHIDACEAE

Grias Gentlei Lundell, sp nov.

Arbor glabra; folia anguste oblanceolata, usque ad 80 cm. longa, 20 cm. lata, apice attenuato-acuminata, basi cuneata; flores 3–7, fasciculati; pedicelli ca. 1 cm. longi; petala 4, raro 5, crassa, glabra, pellucido-punctata, elliptica, usque ad 18 mm. longa, 12 mm. lata; stamina numerosa; ovarium 4-loculare.

Tree, 20 cm. in diam., glabrous. Leaves large, sessile, narrowly oblanceolate, up to 80 cm. long, 20 cm. wide, with glands along the subentire margin, these becoming reddish-black with age; apex attenuate-acuminate, base attenuate and cuneate with age, essentially spathulate, the midrib thick and prominent on both surfaces, the lateral nerves 20 to 30. Flowers usually 3 to 7, fasciculate on old wood, the basal bracts ovate-deltoid, 2 to 3 mm. long, acute. Pedicels, including hypanthium, scarcely 1 cm. long, glabrous. Calyx entire, or essentially so in bud, splitting at anthesis into two or more segments 3 to 4 mm. long. Petals 4, sometimes 5, thick, glabrous, pellucid-punctate, inaequilateral, asymmetrically elliptical, up to 18 mm. long, 12 mm. wide, rounded at apex. Androecium about 8 mm. long, the stamens numerous, the anthers about 0.5 long, longitudinally dehiscent, scarcely thicker than the filaments. Ovary 4-celled, stigma 4-lobed.

BRITISH HONDURAS: Toledo District, in broken ridge, upper reach Temash River, February, 1945, *Percy H. Gentle 5194* (type, LL), flowers borne on stem, whitish, the bark dark, the wood white, "*bombowood*", "*wild mammy*".

The relationship of *G. Gentlei* is with *G. integrifolia* (Standl.) R. Knuth, a tree described from Nicaragua, and known to me only from the brief and rather inadequate original description. On the basis of its smaller calyx and receptacle, long acuminate leaf blades with glandular margin, and fewer leaf veins, a distinct species appears to be represented. Evidently all the Central American species of the genus are very closely allied, and the differences between them minor. Again we need more material!

MYRTACEAE

CALYPTRANTHES BELIZENSIS (Standl.) Lundell, Phytologia 1: 218. 1937.

Eugenia belizensis Standl., Publ. Field Mus. Bot. 11: 137. 1932.

BRITISH HONDURAS: El Cayo District, Mountain Pine Ridge, in and along brook, February 25, 1931, *H. H. Bartlett 11756* (type, F), shrub, up to 10 ft. high.

The species, known only from the fruiting type collection, has two foliaceous contorted cotyledons which are typical of the genus *Calyptranthes*.

CALYPTRANTHES CALDERONII Standl., Publ. Field Mus. Bot. 4: 318. 1929.

BRITISH HONDURAS: El Cayo District, Mountain Pine Ridge, Vaquero, at edge of stream, Aug. 8, 1936, *C. L. Lundell 6857* (LL), shrub or treelet, height 3 m.

This rare plant appears to be related to *C. belizensis* (Standl.) Lundell, which grows in the same area.

Eugenia anglohonduransis Lundell, sp. nov.

Arbor omnino glabra, ramis gracilibus; folia chartacea, petiolata, petiolo crasso 4–6 mm. longo; lamina anguste lanceolata, 10.5–20 cm. longa, 3–4.5 cm. lata, basi acuta, apice cuspidato-acuminata; flores in axillis foliorum vel ad nodos defoliatos fasciculati, pedicellis 7–17 mm. longis; sepala 4, ovata, 3.5–5 mm. longa, acutiuscula. Petala obovata vel obovato-oblonga, 8–10 mm. longa, ciliata. Fructus globosus, ad 1.8 cm. diam.

Tree, 25 cm. diam., entirely glabrous, excepting flowers; twigs slender, terete, enlarged at the nodes. Leaves chartaceous, paler beneath, petiolate; leaf blades narrowly lanceolate, 10.5 to 20 cm. long, 3 to 4.5 cm. wide, narrowed to an acute base, apex long cuspidate-acuminate, costa impressed above, prominent beneath, veins inconspicuous, scarcely discernible, faintly impressed above. Petioles short, thick, canaliculate, 4 to 6 mm. long. Flowers fasciculate, borne on naked branches below the leaves and axillary. Pedicels slender, glabrous, 7 to 17 mm. long at anthesis, the bractlets at apex broadly ovate, up to 1 mm. long but usually smaller, ciliate, acute. Flower buds 5 to 7 mm. long, apiculate, glabrous. Sepals 4, ovate, acutish or obtuse, 3.5 to 5 mm. long, punctate. Petals obovate or obovate-oblong, 8 to 10 mm. long, ciliate. Stamens up to 9 mm. long. Receptacle puberulent with reddish hairs. Ovary 2-celled, many-ovulate. Fruits globose, up to 1.8 cm. in diameter, with walls up to 4 mm. thick.

BRITISH HONDURAS: Stann Creek District, Commerce Bight Pine Ridge, in wooded island, Aug. 30, 1954, *Percy H. Gentle 8354* (type, LL), tree, 8 in. diam., flowers white, "*wild guava*".

E. anglohondurensis is similar, according to description, to *E. simiarum* Standl. & Steyerm., but differs at once in its flowers with sepals and petals twice as large, and with shorter petioles.

EUGENIA MOURIRIOIDES Lundell, Am. Midl. Nat. 2: 480. 1943.

BRITISH HONDURAS: Toledo District, Monkey River, Jenkins Creek in hammock in pine ridge, Sept. 11, 1942, *Percy H. Gentle 4142* (isotype, F, LL), tree, 5 in. diam., flowers white, "*wild guava*". Near Condemned Branch Pine Ridge, in cohune ridge, April 30, 1945, *Gentle 5358* (LL), tree, 7 in. diam., white flowers on stem, bark dark, wood dark brown and hard, "*wild guava*".

In the type collection the pedicels at anthesis vary from 1 to 7 mm. long, while in *Gentle 5358* the flowers at anthesis are all sessile. Alternate sepals are narrow and oblong and up to 6 mm. long.

In *E. Schippii* Standl., described from fruiting material, the pedicels are up to 1.3 cm. long, and the persistent sepals are ovate and broader.

These differences, especially pedicel lengths, may not be of significance, as I have indicated from field observations on *E. Lundellii* Standl. and *E.*

Winzerlingii Standl. (Wrightia 2: 57–58. 1960). Additional collections are needed to clarify relationships.

Eugenia Percivalii Lundell, sp. nov.

Arbor, ramulis minute puberulis; folia novella puberula, glabrata, petiolata; lamina chartacea, lanceolato-elliptica, 8–15 cm. longa, 3.5–6 cm. lata, basi acutiuscula, apice obtusa vel acuminata, acumine late obtuso, petiolo crasso, 7–10 mm. longo; inflorescentia racemosa, minute puberula, pedicellis 1–2.5 mm. longis; hypanthium ca. 2 mm. longum; sepala cupulata, ovata vel suborbicularia, 2–3 mm. longa, puberula; petala oblonga, 5–6 mm. longa; bracteolae ca. 0.5 mm. longae; ovarium 2-loculare.

Tree, 20 cm. diam., twigs of new growth slender, terete, black punctate, very minutely puberulent, glabrate early. Very young leaves minutely puberulent, glabrate early. Leaves petiolate, chartaceous, paler beneath, lanceolate-elliptic, 8 to 15 cm. long, 3.5 to 6 cm. wide, base acutish, apex obtuse or acuminate, the acumen very obtuse, costa plane above, elevated beneath, the lateral veins inconspicuous, 11 to 15 pairs. Petioles thick, canaliculate, 7 to 10 mm. long. Flowers borne in very short axillary racemes, appearing fasciculate, the rachis up to 4 mm. long, densely and very minutely puberulent. Pedicels finely puberulent, at anthesis 1 to 2.5 mm. long, the apical bractlets broadly ovate, scarcely 0.5 mm. long. Calyx minutely puberulent, the hypanthium about 2 mm. long; sepals unequal, cupulate, the smaller pair ovate, about 2 mm. long, the larger pair suborbicular, about 3 mm. long. Petals oblong, 5 to 6 mm. long, punctate. Receptacle puberulent. Stamens up to 7 mm. long. Ovary 2-celled, with several ovules in each cell. Fruits unknown.

BRITISH HONDURAS: Toledo District, Edward's Road beyond Columbia, on hill top near Central Camp, in high ridge, May 16, 1951, *Percy H. Gentle 7332* (type, LL), tree, 8 in. diam., flowers white.

E. simiarum Standl. & Steyerm., is closely related, but that species has much longer pedicels, a smaller calyx, and larger bractlets. The young growth, inflorescence, and flowers of *E. Percivalii* are minutely puberulent, while *E. simiarum* is described as entirely glabrous.

This species is named for the collector, who was baptised Percival Hindebrand Gentle!

Eugenia peroblata Lundell, sp. nov.

Arbor parva, ramulis teretibus, hirtellis; folia chartacea, petiolata, petiolo 5–7 mm. longo; lamina lanceolata, 9–13 cm. longa, 2.5–3.8 cm. lata, basi obtusa, apice caudato-acuminata; bacca oblata, ca. 1.5 cm. longa, 2.5 cm. diam.

A small tree, 5 cm. diam., with slender terete twigs flattened at the nodes, the branchlets persistently hirtellous. Leaves opposite, the petioles and midrib above pubescent with spreading hairs, otherwise glabrous (with

age); petioles terete, 5 to 7 mm. long; leaf blades chartaceous, lanceolate, 9 to 13 cm. long, 2.5 to 3.8 cm. wide, base obtuse, apex caudate-acuminate, concolorous, the numerous veins subparallel. Fruits strongly oblate, about 1.5 cm. long, 2.5 cm. diam. Cotyledons free, fleshy, plano-convex, radicle short but conspicuous.

BRITISH HONDURAS: El Cayo District, Gorge Creek section, Humming Bird Highway, in high ridge on hill slope, Aug. 26, 1955, *Percy H. Gentle 8845* (type, LL), tree, 2 in. diam.

The material is unsatisfactory. Only loose fruits are available, and these appear to have been borne at defoliated nodes. Their oblate form and the free, plano-convex, fleshy cotyledons are distinctive.

EUGENIA SCHIPPII Standl., Publ. Field Mus. Bot. 11: 137. 1932.

BRITISH HONDURAS: Seine Bight, in open forest, alt. 5 ft., Nov. 26, W. A. *Schipp 669* (type, F), tree, 6 in. diam., 25 ft. high, flowers white, fruit black. Toledo District, Monkey River, Jenkins Creek, in pine ridge, Aug. 1, 1942, *Percy H. Gentle 4063* (LL), tree 7 in diam., "*wild guava*".

The relationship of *E. Schippii* is with *E. mouririoides* Lundell.

MYRCIARIA FLORIBUNDA (West, ex Willd.) Berg, Linnaea 27: 330. 1856.

Eugenia floribunda West, ex Willd., Sp. Pl. 2: 960. 1800.
Eugenia O'Neillii Lundell, Bull. Torrey Club 64: 555. 1937.
Myrciaria O'Neillii (Lundell) I. M. Johnston, Sargentia 8: 228. 1949.

GUATEMALA: Department of Peten, Dos Lagunas, on Ixcanrio Road, about 4 km. NEE of the village, in *zapotal*, Oct. 11, 1960, *Elias Contreras 1512* (LL), tree, 3 in. diam., 25 ft. high, "*guayabillo*"; Dos Lagunas, on Uaxactun trail, about 4 km. SW of the village, in *zapotal*, Oct. 26, 1960, *Contreras 1562* (LL), tree, 3 in. diam., 30 ft. high, "*guayabillo*".

The genus has not been reported previously from Guatemala.

PSIDIUM YUCATANENSE Lundell, Contr. Univ. Mich. Herb. 7: 35–36. 1942.

GUATEMALA: Department of Peten, Tikal National Park, in *tintal* on *pinal* trail, in Bajo de Santa Fe west of Isla de Los Pavos, July 30, 1960, *Elias Contreras 1340* (LL), tree, 5 in. diam., 35 ft. high, "*guayabillo*".

Closely related to *P. Sartorianum* (Berg) Ndzu., this is the first record of the species in Guatemala. The peduncles usually are 1-flowered, but occasionally a 3-flowered cyme is present.

MELASTOMACEAE

MOURIRIA GLEASONIANA Standl., Publ. Field Mus. Bot. 22: 361–362. 1940.

BRITISH HONDURAS: Stann Creek District, Freshwater Creek, creekside, in *acahual*, Aug. 30, 1954, *Percy H. Gentle 8353* (LL), tree, 7 in. diam., "*wild guava*".

M. Gleasoniana, not previously recorded from Belice, is very closely allied to *M. Muelleri* Cogn. and *M. exilis* Gleason.

BIGNONIACEAE

SCOBINARIA VERRUCOSA (Standl.) Seibert, Carnegie Inst. Publ. 522: 408–409, *pl. 5*. 1940.

BRITISH HONDURAS: Stann Creek District, Canada Hill-Alta Vista Road, in cohune ridge, Oct. 24, 1953, *Percy H. Gentle 8045* (LL), woody vine.

In this collection the immature capsules are subterete and densely tuberculate, resembling those of *Onohaulcoa Seleri* (Loes.) Lundell. In *S. verrucosa* the mature capsules are compressed-linear.

INVESTIGATIONS OF SWAMP SOILS FROM THE *TINTAL* AND *PINAL* ASSOCIATIONS OF PETEN, GUATEMALA

W. Derby Laws

Soils samples from Bajo de Sante Fe, an extensive swamp in the Tikal National Park of Guatemala, were taken by Dr. C. L. Lundell to study edaphic conditions of the *tintal* (logwood) and *pinal* (pine hammock) plant associations. The *pinal*, an isolated hammock of some two square kilometers, is located about 10 miles 77° ENE of Tikal. The site from which the *tintal* soil samples were taken is near Aguada Pucte at Tikal on Aguada Terminos trail.

In the laboratory, these bulk samples were dried, broken into small fragments with a wooden rolling pin and then ground to pass a 100 mesh sieve using a small stainless steel hammer mill equipped with stainless steel hammers.

The surface soil sample (0 to 6 inches) from the *pinal* contained so many fine root hairs and pieces of roots from the pine which could not be removed, that the sample would have been adversely influenced by the residues. Therefore, this sample was screened and all material which passed the ten millimeter sieve and remained on the five millimeter sieve was then picked free of roots by hand so as to obtain a soil sample free of pine residue, before grinding (Tikal 4: 0–6″ a). The material which passed the five millimeter sieve and contained the pine residue was also ground and analyzed along with the other samples obtained (Tikal 4: 0–6″ b).

The soils from Tikal were assigned laboratory numbers as follows:

Tikal 3:	0–6″	From *tintal*, Feb. 19, 1959 (*Lundell 15653*).
	6–12″	From *tintal*, Feb. 19, 1959 (*Lundell 15653*).
	18–24″	From *tintal*, Feb. 19, 1959 (*Lundell 15653*).
	Below 12′	Clay from pit in *tintal*, July 1959.
Tikal 4:	0–6″ a	From *pinal*, Feb. 1960 (*Lundell 16758*), plant residues removed.
	0–6″ b	From *pinal*, Feb. 1960 (*Lundell 16758*), plant residues included.
	6–12″	From *pinal*, Feb. 1960 (*Lundell 16758*)
	12–36″	From *pinal*, Feb. 1960 (*Lundell 16758*)

Throughout this report the soils will be labeled Tikal 3 and 4 and the depth of sampling indicated.

A. PHYSICAL MEASUREMENTS

1. *Mechanical Analysis.* A mechanical analysis of these soils was made by the nascent hydrogen method of Jeffries and Jackson.[1] A 2 gram sample was placed in 100 ml. centrifuge tube and washed with tenth normal hydrochloric acid until all calcium had been removed as shown by testing with sodium oxalate solution. The samples were then dried and the weight lost due to leaching with hydrochloric acid determined. They were then treated with ten per cent hydrogen peroxide until the organic matter was completely oxidized when they were again weighed to determine the organic matter content which is estimated by loss in weight. The samples were then treated with a potassium oxalate and oxalic acid mixture along with magnesium ribbon to remove the iron and aluminum oxide coatings from the soil particles. After the iron and aluminum oxide had been removed the samples were sodium saturated with sodium carbonate solution pH 9 and separated into sands, silts and clays by washing through a 300 mesh sieve to remove the sand and then stirring and centrifuging repeatedly to separate silt from clay.

In this procedure there is a possibility that some of the clay may be left with the silt if an insufficient number of stirrings are used. This may have happened since the soil samples treated this way do not show as high a clay content as was obtained on the *tintal* samples when the mechanical analysis was made by the pipette method. However, results would be expected to be somewhat lower because the fractions soluble in 0.1 N HCl, the organic matter, and the iron and aluminum coatings were removed from the soil particles by the procedures used. Most of these materials would be a part of the clay fraction in the pipette method. The results obtained are summarized in Table 12.

The data in Table 12 indicate that the samples from location Tikal 3 in the *tintal* contain more clay than the samples from the *pinal* location Tikal 4. Because of the great number of washings and stirrings involved in the method used there was much opportunity for error in separation of sand, silt and clay. Therefore, it was decided to check these results with the hydrometer which gives an approximate measure for the clay. It was found that Tikal 3, 0–6″ contained 84.7 % clay while Tikal 4, 0–6″ contained only 57.7 % clay. Tikal 3, 6–12″ contained 88.0 % clay while Tikal 4, 6–12″ contained 68.7 % clay and Tikal 3, 18–24″ contained 92.7 % while Tikal 4, 12–36″ contained 74.7 % clay by the hydrometer analysis. Therefore, it is apparent that the soil from the *pinal* contains less clay than that from the *tintal*. However, it is still very high in clay content when compared with most agricultural soils.

The clay fraction from the samples in Table 12 were ignited in the muffle furnace to determine loss on ignition and then fused with sodium carbonate and analyzed to determine if there were differences in the clays. The results are summarized in Table 13.

[1] Mineralogical Analysis of Soils. Soil Science 68: 63–64. 1949.

Table 12

THE VARIOUS FRACTIONS OBTAINED FROM THE TIKAL SOILS BY THE NASCENT HYDROGEN METHOD (VALUES ARE PERCENTS OF OVEN DRY SAMPLE)

Location	Depth	HCl Sol.	O.M.[a]	Iron	Sand	Silt	Clay
Tikal 3	0–6″	2.80	3.08	5.05	0.84	8.12	71.69
	6–12″	1.41	1.40	3.10	0.56	9.01	81.95
	18–24″	1.39	0.00	6.11	0.26	8.06	83.34
	Below 12′	1.69	0.85	4.79	0.40	8.73	81.70
Tikal 4	0–6″ a	1.03	1.55	2.58		50.52	27.32
	0–6″ b	1.81	3.36	3.10	9.30	52.71	31.00
	6–12″	1.59	0.53	2.12	3.96	36.68	53.30
	12–36″	0.80	0.27	2.14	2.94	35.57	55.35
L.S.D. @ 5%*		0.95	1.42	2.70	0.90	2.52	14.29

* A difference as large as indicated in this row of figures may result from inaccuracies in the procedure.

[a] Organic matter determined by this method is not comparable to that obtained by dichromic acid oxidation method reported in Table 16.

Table 13

ANALYSES OF THE CLAY FRACTION ISOLATED FROM TIKAL SOILS

Location	Depth	Ignition* Loss	K_2O	SiO_2	Al_2O_3	Fe_2O_3	SiO_2/R_2O_3
Tikal 3	0–6″	11.2	1.54	50.10	31.99	5.33	2.40
	6–12″	11.4	2.02	47.12	30.63	9.19	2.19
	18–24″	11.0	1.29	49.36	33.96	4.53	2.25
	Below 12′	11.2	1.65	49.49	32.64	4.93	2.35
Tikal 4	0–6″ a	12.6	1.90	49.61	34.71	5.00	2.22
	6–12″	11.7	1.79	50.10	32.66	4.39	2.40
	12–36″	11.1	1.61	53.40	31.29	4.50	2.65

* Loss on ignition between 300° and 1000° centigrade.

The data in Table 13 indicate that the clay from both locations is of the montmorillonite type and does not differ appreciably in composition. It should be pointed out that the potassium values in Table 13 are flame photometer determinations on the sodium carbonate fusions and are, therefore, to be considered as approximations, although the relationship existing between the various samples is probably correct.

B. CHEMICAL ANALYSIS

1. *Nitric Acid-Perchloric Acid Digestion.* The soil samples from Tikal were digested with a nitric acid-perchloric acid mixture to determine total phosphorus present. After determination of the phosphorus, the magnesium was determined colormetrically and the calcium, potassium and sodium were determined in the solution using the flame photometer. The values

obtained do not represent the total of the element present but only acid soluble. However, the results do serve as a method of comparing the composition of the samples. All values given in Table 14 represent the average of duplicate determinations for location Tikal 4 and of the four determinations (two in 1959 and two in 1960) for location Tikal 3.

The data in Table 14 give relative values that can serve to compare the mineral status of the various soils analyzed. The values for total phosphorus show that the *tintal* (location No. 3) soil and the soil from the *pinal* (location No. 4) are very low in total phosphorus and are not appreciably different.

The potassium measured in a nitric-perchloric acid digestion was found in previous work to be closely correlated with "fixed" potassium, which is generally considered available to plants. Assuming that potassium determined by this digestion method would have the same relationship to plant production in Tikal soils as it had in eight Texas soils, none should be deficient in potassium, although they are very low and not significantly different.

Table 14

THE CHEMICAL COMPOSITION OF TIKAL SOILS AS DETERMINED IN A NITRIC-PERCHLORIC ACID DIGESTION

Location	Depth	% P	% K	% Mg	% Ca	% Na
Tikal 3	0–6″	.015	.029	.029	0.41	.037
	6–12″	.008	.025	.025	0.38	.046
	18–24″	.004	.022	.093	0.40	.059
	Below 12′	—	—	—	—	—
Tikal 4	0–6″ a	.005	.016	.084	0.16	.027
	0–6″ b	.005	.025	.097	0.15	.026
	6–12″	.004	.021	.063	0.20	.032
	12–36″	.003	.024	.083	0.35	.068
L.S.D. @ P = 5%*		.005	.002	.068	0.08	.004

* Averages may differ by the amount indicated due to inaccuracies in laboratory procedures.

Table 15

CHEMICAL COMPOSITION OF SOILS FROM TIKAL AS DETERMINED BY SODIUM CARBONATE FUSION

Location	Depth	Ignition Loss	% SiO_2	% Al_2O_3	% Fe_2O_3	SiO_2/R_2O_3	% K_2O
Tikal 3	0–6″	18.3	44.72	26.63	7.32	2.43	1.23
	6–12″	14.1	47.00	28.82	7.62	2.37	1.13
	18–24″	12.7	47.71	32.35	6.70	2.21	1.19
Tikal 4	0–6″ a	9.8	69.92	15.44	3.36	6.75	1.23
	0–6″ b	11.3	62.26	11.96	3.03	7.60	1.17
	6–12″	11.8	62.64	19.15	4.42	4.84	1.29
	12–36″	12.1	61.11	19.67	4.65	4.58	1.25

Table 16

THE NITROGEN AND ORGANIC MATTER CONTENT OF GAUTEMALA SOILS FROM THE *Tintal* AND THE *Pinal* OF BAJO DE SANTA FE, PETEN

Location	Depth	% N	% O.M.	O.M./N.	pH
Tikal 3	0–6″	.289	4.31	14.9	5.1
	6–12″	.109	1.55	14.2	4.0
	18–24″	.042	0.77	18.3	3.2
Tikal 4	0–6″ a	.154	3.75	24.4	3.8
	0–6″ b	.195	6.39	32.8	4.0
	6–12″	.079	1.56	19.7	3.8
	12–36″	.036	0.50	13.9	4.0

Table 17

AVAILABLE NUTRIENTS IN TIKAL SOILS AS DETERMINED BY THE MORGAN METHOD

Location	Depth	Nitrate "N"	P	K	Ca	Fe
Tikal 3	0–6″	V. Low	Medium	V. Low	Medium	Low
	6–12″	V. Low	Low	V. Low	Medium	Medium
	18–24″	V. Low	V. Low	V. Low	Medium	High
Tikal 4	0–6″	Low	*	V. Low	V. Low	High
	6–12″	V. Low	*	V. Low	V. Low	High
	12–36″	Low	Medium	V. Low	Medium	High

* Not possible to measure because of off-color solutions.

The sodium found in the digests was closely related to the calcium content in all soils analyzed. This indicates that the parent material of each soil may contain considerable sodium.

2. *Sodium Carbonate Fusion.* The soil samples were ignited in the muffle furnace to determine loss on ignition and then fused with sodium carbonate and analyzed the same as the clay samples. The results are summarized in Table 15.

The silica-sesquioxide ratio of the soil from the *tintal* (Tikal 3) differs very little from that of the clay isolated from these soils. The same ratio for the soils from the *pinal* (Tikal 4) is much higher for the soil than for the clay isolated from it. This shows the increased sand present in the soil from this location. The marked decrease in the silica-sequioxide ratio with depth also indicates the decrease in sand and the increase in clay with depth.

3. *Nitrogen, Organic Matter and pH.* The soils were analyzed for total nitrogen by the Kjeldahl method, for easily oxidizable organic matter by the dichromic acid oxidation method and the pH was determined with the glass electrode in paste of one part soil and five parts water. The results are summarized in Table 16.

The big difference in the soils from the *tintal* and the *pinal* is in the ratio of easily oxidizable organic matter to nitrogen. The ratio of the *tintal* soil is quite low while that from the *pinal* is higher than usually found in soils.

A more complete characterization of the organic matter would be required to determine the reasons for the differences.

4. *Available Plant Nutrients.* The available plant nutrients were determined by using the Universal Soil Extracting method of Morgan, or use of Morgan's reagent.[2] The data obtained are presented in Table 17.

The soils from the *pinal* were lower in available calcium than the soils from the *tintal* (compare with values in Table 14). They were also higher in available iron (which indicates poor drainage) than samples collected from the *tintal* (location No. 3). However, it should be kept in mind that the samples from the *tintal* had stood in the laboratory for a full year longer than samples from the *pinal* (location No. 4) which would allow the iron to oxidize and become unavailable to the extracting reagent. There is nothing in the data in Table 17 to indicate an appreciable difference in soils from the *pinal* and the *tintal*.

CONCLUSIONS

Based upon the analysis made there is little difference, chemically, in the soil from the *tintal* (Tikal No. 3) collected in 1959 and that from the *pinal* (Tikal No. 4) collected in 1960. The *pinal* soil is lower in clay content but is still sufficiently high in clay to be classed as a clay soil. The organic matter in the top 12″ of soil from the *pinal* was more carbonaceous than organic matter from soil at the same depth in the *tintal*.

[2] Chemical Soil Diagnoses by the Universal Soil Testing System. Connecticut Agr. Expt. Sta. Bull. 450. 1941.

FOUR NEW SOLANUMS IN SECTION TUBERARIUM

Donovan S. Correll

Although it is immeasurably more satisfying to try to bring order out of chaos in a genus, or part of a genus such as section Tuberarium of *Solanum*, rather than to continue describing new species, it is to be expected that during the preparation of a monograph for any group of plants new entities will be found which must of necessity be described. Such is the case of the following.

Solanum carchiense Correll, sp. nov. Fig. 24.

Planta vitinea et multum ramosa, ramulis et foliis pubescentibus vel tomentosis cum pilis fulvis, aetate glabrescens; folia simplicia vel imparipinnata, foliolum terminale acutum, ovatum vel ovato-ellipticum, cum foliolo terminali quam foliolis lateralibus multo majore; inflorescentia pauciflora, pseudoterminalis; pedunculus abbreviatus; pedicelli basi vel prope basim articulati, sparsim pilosi; calyx campanulatus, pubescens, cum quinque acuminibus brevibus; corolla stellata; lobi elliptico-lanceolati et acuti; antherae in circuitu lineari-ellipticae; filamenta gracilia, glabra; stylus infra medium minute cellulo-papillosus; fructus ignoti.

Plant a much-branched vine; stem slender and wiry, the older sections glabrous or glabescent, the younger branches densely pubescent to tomentose with tawny hairs; leaves simple to odd-pinnate (with as many as 5 leaflets), up to 7.5 cm. long, the young leaves tomentose on the lower surface and densely pubescent on the upper surface, becoming less pubescent with age, with a petiole up to 2 cm. long which is articulate at the base; leaflets (or simple leaf) ovate to ovate-elliptic, rounded to truncate at the base, acute at the apex, up to 6 cm. long and 2.5 cm. wide; lateral leaflets (when present) 2 or 4, greatly reduced, sessile to shortly petiolulate; pseudostipular leaves lunate, less than 1 cm. long; inflorescence pseudoterminal on the branches, composed of 6 or 8 more or less clustered flowers; peduncle abbreviated, up to about 1 cm. long, branched above, densely tawny pubescent; pedicels about 1.2 cm. long, articulate at or near the base, laxly and sparsely pilose above the articulation; calyx campanulate, 3.5–4 mm. long, densely pubescent, with five short acumens at apex, the acumens 1 mm. or less long; corolla stellate, divided to well below the middle into elliptic-lanceolate lobes that are 1–1.3 cm. long and somewhat thickened at the acute apex; anthers narrowly elliptic in outline, 4–4.5 mm. long; filament slender, essentially terete, about 1.5 mm. long, glabrous; style about 1 cm. long, minutely cellular-papillose below the middle; fruits unknown.

FIG. 24. *Solanum carchiense* Correll. 1, section of flowering plant, × ½; 2, calyx, spread out, × 1½; 3, corolla, spread out, × 1½; 4, stamen, dorsal view, × 3; 5, pistil, × 3. Illustrated by Vivien Frazier.

ECUADOR: Prov. Carchi, between El Pun and Tulcan, November 1952, *F. Fagerlind & G. Wibom 1475* (S, type).

Solanum carchiense belongs to the series Appendiculata in subsection Basarthrum of section Tuberarium in *Solanum*. Similarly to all of the species in this series, it is a vine. The plant shows affinity with several Mexican species, primarily *S. appendiculatum* H. & B. ex Dunal and *S. tacanense* Lundell.

The name, *carchiense*, is taken from the locality, Carchi, Ecuador, where this species was collected.

Solanum Earl-Smithii Correll, sp. nov. Fig. 25.

Planta erecta, ramosissima, rhizoma grossa, fibrata, probaliter non tuberifera; caulis robustus, flexuosus, simplex vel ramosus; folia imparipinnata, supra atro viridia et glabro-vernicosa, subtus canescenti-viridia et dense puberula, cum septem vel novem foliolis et laminis compluribus inter foliola; foliola lateralia elliptica vel elliptico-lancelolata, apice obtusa vel acuta, margines repando-undulati vel crenulati; foliolum terminale foliolis lateralibus aliquid majus; inflorescentia multiflora, paniculata; pedicelli infra medium vel prope basim articulati, glabri vel sparsim puberuli; flores albi; calycis lobi rotundati vel subquadrati, glabri vel sparsim pilosi; corolla rotato-pentagona, acuminibus plusminusque cucullatis; antherae in circuitu oblongo-lanceolatae; filamenta glabra; stylus infra medium cellulo-papillosus; stigma globosum emarginatum; fructus globosus, viridis.

Plant stout, bushy, up to 6 dm. or more tall, from a thick fibrous rootstock and apparently non-tuber-bearing; stem stout, more or less zigzag, puberulent, simple or branched; leaves odd-pinnate, deep green and shiny-glabrous on the upper surface, dull grayish green and densely puberulent on the lower surface, 10–27 cm. long, usually with several interstitial leaflets; rachis more or less puberulent; leaflets 7 or 9, the lowermost pair greatly reduced, sessile to shortly petiolulate, the margins repand-undulate to conspicuously crenulate; lateral leaflets asymmetrically elliptic to broadly elliptic or elliptic-lanceolate, obtuse to acute at the apex, the basiscopic side more or less auriculate at the base, the acroscopic side deeply recessed and rounded at the base, up to 9 cm. long and 4.5 cm. wide, usually much smaller; terminal leaflet similar to the lateral ones but frequently somewhat larger and sometimes suborbicular-elliptic, rounded to subcordate at base; pseudostipular leaves semielliptic, broadly lunate or falcate, up to 1.5 cm. long; inflorescences pseudoterminal and/or lateral, a conspicuously many-flowered and showy panicle, with the 3 main branches divergent and spreading; peduncle up to 6 cm. long, usually much abbreviated as compared with the large inflorescence, 3-branched above, essentially glabrous to lightly puberulent; pedicels 1.3–2 cm. long, articulate well below the middle or to near the base, glabrous or sparingly puberulent; flowers white and usually with a light greenish center; calyx 3–5 mm. long, shallowly

FIG. 25. *Solanum Earl-Smithii* Correll. 1, upper part of flowering plant, × ½; 2, calyx, spread out, with pistil partially attached, × 3; 3, corolla, spread out, × 1½; 4 stamen, dorsal view, × 3; 5, fruit, × ½. Illustrated by Vivien Frazier.

lobed with the lobes broadly rounded to subquadrate and apiculate, glabrous or with a few scattered hairs; corolla rotate-pentagonal, about 2.5 cm. in diameter, the acumens more or less cucullate; anthers 5–6 mm. long, oblong-lanceolate in outline; filament 1–1.5 mm. long, glabrous; style 9–10 mm. long, cellular-papillose on the lower half, the stigma globose and commonly notched; fruit orbicular, deep green, about 1.5 cm. in diameter.

PERU: Cajamarca Dept., in disturbed soil along road, 58 km. from Cajamarca, between Chilete and mountain pass, 1650 m. alt., leaves deep green and shiny above, flowers white, rotate-pentagonal, March 24, 1960, *Donovan S. Correll & Earl E. Smith P836* (LL, type).

This is one of several distinctive and unique species that have been discovered in northern Peru during the last few years. Dr. Carlos Ochoa has recently described, among others, *S. cajamarcense*, *S. ingaefolium*, *S. chiquidenum* and *S. mochiquense* from this region—all of which are unusually individualistic.

These species, of apparently local occurrence, if not endemic, are found more or less isolated in widely separated places. There is little doubt that when more intensive and prolonged exploration is undertaken in such areas additional species new to science will be discovered.

Solanum Earl-Smithii shows some vegetative relationship with *S. mochiquense* and *S. cajamarcense* and, in its cucullate acumens of the corolla lobes, some floral relationship with *S. chiquidenum*. The exact relationship of these plants and the series into which they should be placed is yet to be worked out.

It is a pleasure to name this plant for my good friend and colleague, Dr. Earl E. Smith of the International Cooperative Administration in Peru, who not only was my agreeable companion during my several forays in Peru, but was also a most willing helper when it came to the hard work of hunting for plants and digging for tubers.

Solanum Woodsonii Correll, sp. nov. Fig. 26.

Planta ramosissima, patens; caulis gracilis, aliquid pilosus, alatus; folia imparipinnata, pubescentia, sine laminis inter foliola; foliola quinque vel septem, subsessilia vel breviter petiolulata, elliptica vel late ovata vel suborbiculata, obtusa vel acuta; inflorescentia pauciflora; pedicelli circiter in medio vel super medium articulati, glanduloso-pubescentes; calyx crassus, lobi ovato-triangulati et apiculati; corolla rotato-pentagona, acuminibus brevibus; anthera ad medium basi dorso lobulata; filamenta lata, sparsim hirsuta; stylus gracilis, glabrus; fructus (juvenales) ovoidei, conoidi.

Plant low, bushy, spreading, up to at least 2 dm. tall (doubtless much taller); tubers (if present) unknown; stem slender, sparsely pilose, narrowly winged; leaves odd-pinnate, up to 13 cm. long, with shiny coarse hairs on upper surface, more finely and densely pubescent on lower surface, without

interstitial leaflets; leaflets 5 or 7; lateral leaflets subsessile to shortly petiolulate, elliptic to broadly oval, rounded at the slightly oblique base, obtuse to acute at apex, up to 3.8 cm. long and 2 cm. wide; terminal leaflet somewhat larger than the lateral ones, sometimes suborbicular; pseudo-

FIG. 26. *Solanum Woodsonii* Correll. 1, upper part of flowering plant, × ½; 2, calyx, spread out, × 3; 3, corolla, spread out, × 1½; 4, stamen, ventral view, × 3; 5, stamen, dorsal view, × 3; 6, pistil, × 3. Illustrated by Vivien Frazier.

stipular leaves obliquely ovate, 1–1.5 cm. long; inflorescence pseudoterminal, few-flowered; peduncle about 6 cm. long, sparsely pubescent below, glandular-pubescent above; pedicels up to 1.7 cm. long articulate at about or above the middle, glandular-pubescent; flowers pale purple; calyx fleshy-thickened, about 4.5 mm. long, divided to above the middle into triangular-ovate apiculate lobes, shortly pubescent; corolla rotate-pentagonal, 2.5–3 cm. in diameter, the acumens short; anthers about 4 mm. long, lanceolate in outline, dorsally lobulate in center at base; filaments about 2 mm. long, sparsely hirsute, broad; style slender, about 8 mm. long, glabrous, the small stigma abruptly capitate; fruits (immature) ovoid-conic.

PANAMA: Province of Chiriquí, Volcán de Chiriquí, Potrero Muleto to summit, 3500–4000 m. alt., flowers pale purple, July 13–15, 1940, *R. E. Woodson, Jr. & R. W. Schery 399* (GH, type; MO, isotype).

Solanum Woodsonii is a species of apparently higher elevations than *S. oxycarpum* Schiede, to which it is closely allied. It might be considered as a somewhat geographical transition species between the typically more northern *S. oxycarpum* and the Venezuelan *S. otites* Dun. The small dorsal lobule at the base of the anthers and the short broad leaflets may be critical.

This is one of the many excellent collections that Dr. Woodson and his colleagues have obtained in their exploration of Panama for the *Flora of Panama*. It is a pleasure to name this species for the senior author of that fine work.

Solanum Hintonii Correll, sp. nov. Fig. 27.

Planta gracilis, erecta, glabra (foliis sparsim pubescentibus exceptis), probaliter tuberifera; folia imparipinnata sine laminis inter foliola; foliola quinque vel septem, parva, lanceolata, acuta vel acuminata; inflorescentia multiflora, cymoso-paniculata, ramis diffusis; pedunculus abbreviatus; pedicelli graciles in medio vel infra medium articulati; calyx crassus, lobi ovato-triangulati et acuminati; corolla stellata; lobi reflexi, plerumque lineari; antherae in circuitu oblongo-ellipticae; filamenta glabra; stylus gracilis, prope apicem curvatus; fructus ignoti.

Plant slender, erect or erect-ascending, up to 1.25 m. tall, glabrous throughout except for the very sparsely pilose leaves, probably tuberiferous; tuber (if present) unknown; stem slender, stramineous, apparently terete; leaves odd-pinnate, up to 14 cm. long, usually about 10 cm. or less long, without interstitial leaflets; petiole up to 3.5 cm. long; leaflets 5 or 7; lateral leaflets asymmetrically lanceolate, rounded at the oblique base, acute to acuminate at apex, up to 3.5 cm. long and 1.2 cm. wide; terminal leaflet similar to the lateral ones, sometimes slightly larger; pseudostipular leaves lunate, falcate, about 7 mm. long; inflorescence a many-flowered diffuse cymose panicle, the main branches wide-spreading and sometimes intricate; peduncle up to 3 cm. long, much-abbreviated as compared with

FIG. 27. *Solanum Hintonii* Correll. 1, upper part of flowering plant and an individual inflorescence, × ½; 2, calyx, spread out, × 3; 3, corolla, spread out, × 1½; 4, stamen, dorsal view, × 3; 5, pistil, × 3. Illustrated by Vivien Frazier.

the large inflorescence; pedicels slender, 8–13 mm. long, prominently articulate at or below the middle; flowers probably creamy white; calyx thick-herbaceous, about 5 mm. long, divided to about or above the middle into ovate-triangular acuminate lobes; corolla stellate, about 2 cm. in diameter, the usually narrow lobes strongly reflexed; anthers oblong-elliptic in outline, about 4 mm. long; filaments 1–1.5 mm. long, glabrous; style 7–8 mm. long, glabrous, slender, curved near apex; fruits unknown, the ovary ellipsoid.

MEXICO: México State, District of Temascaltepec, Peñón, stone fence, plant 1.25 m. high, 1700 m. alt., August 10, 1933, *George B. Hinton 4416* (US, type).

The short leaves that are without interstitial leaflets, the unique cymosely paniculate and diffusely branched inflorescences, and the stellate corolla are a combination of characteristics that distinguish this species. Judging from dried material, the flowers might have been yellowish white in color.

This species shows no obvious relationship with any other Mexican or Central American *Solanum*. The series to which it is apparently most closely allied is Conicibaccata.

It is a distinct pleasure to name this plant for its collector, George B. Hinton, who has contributed so much to our botanical knowledge of Mexico through his excellent collections.

The writer wishes to acknowledge that this is a part of the project on the section Tuberarium of *Solanum* which is being supported, in part, by a grant (NSF-G4440) from the National Science Foundation.

ACANTHACEAE AMERICANAE NOVAE VEL CRITICAE II

SEVEN NEW SPECIES FROM COLOMBIA AND SOME ADDITIONAL NOTES

EMERY C. LEONARD

The descriptions in this paper were based chiefly on specimens collected by Kjell von Sneidern or Martin Schneider lent for study by the Botanical Museum of the University of Stockholm. They were received after the publication of my Acanthaceae of Colombia (Contr. U. S. Nat. Herb. Vol. 31, 1958).

The numbers used for the species are those of my revision.

11a. **Mendoncia tetragona** Leonard, sp. nov. Fig. 28.

Planta volubilis, caulibus, quadrangularibus angulis anguste alatis, glabris vel parce strigosis; lamina foliorum oblongo-ovata, apice abrupte acuminata, apice ipso obtuso et mucronato, basi acuta, submembranacea, integra vel undulata, utrinque glabra, costa et venis lateralibus aliquanto obscuris strigosis exceptis, supra cystolithis rectis, vel angularibus vel subinde stellatis praeditis; petioli graciles, glabri vel in canalibus plus minusve strigosi; flores (1–2) axillares; pedicelli graciles, glabri vel basin versus strigosi, torti, sulcati; bracteae membranaceae, oblongae, apice rotundatae et emarginatae et apiculatae, basi rotundatae, externe glabrae vel costa parce strigosae, intus glabrae; drupa oblonga, leviter compressa, angulis acutis, utrinque rotundata, glabra, minute rugosa.

Liane; stem quadrangular, the angles sharp or narrowly winged, glabrous or sparingly strigose, the hairs upwardly appressed, up to 0.16 mm. long; leaf blades oblong-ovate, widest near the middle, up to 12 cm. long and 5.5 cm. wide, the tip abruptly acuminate (the tip itself blunt and terminating in a mucro 2 to 2.5 mm. long) acute at base, rather thin, entire or undulate, both surfaces glabrous except the costa and lateral veins (3 or 4 pairs), the costa strigose, the veins sparingly so or with the hairs sometimes spreading or ascending, all of the hairs straight, rigid and up to 0.25 mm. long, the venation of both surfaces rather obscure, the upper surface of the blades bearing inconspicuous straight, angled or sometimes stellate cystoliths (potentially thickened hair bases), the lower surface of the blades minutely and inconspicuously rugose; petioles 2 to 4 cm. long, slender, glabrous or the channels more or less strigose; flowers solitary or in pairs borne in the axils of the leaves, the pedicels very slender, 2 to 3.5 cm. long, glabrous or sparingly strigose toward base, grooved; bracts thin, oblong, 5.5 cm. long, 1.2 cm. wide, rounded, emarginate and apiculate at

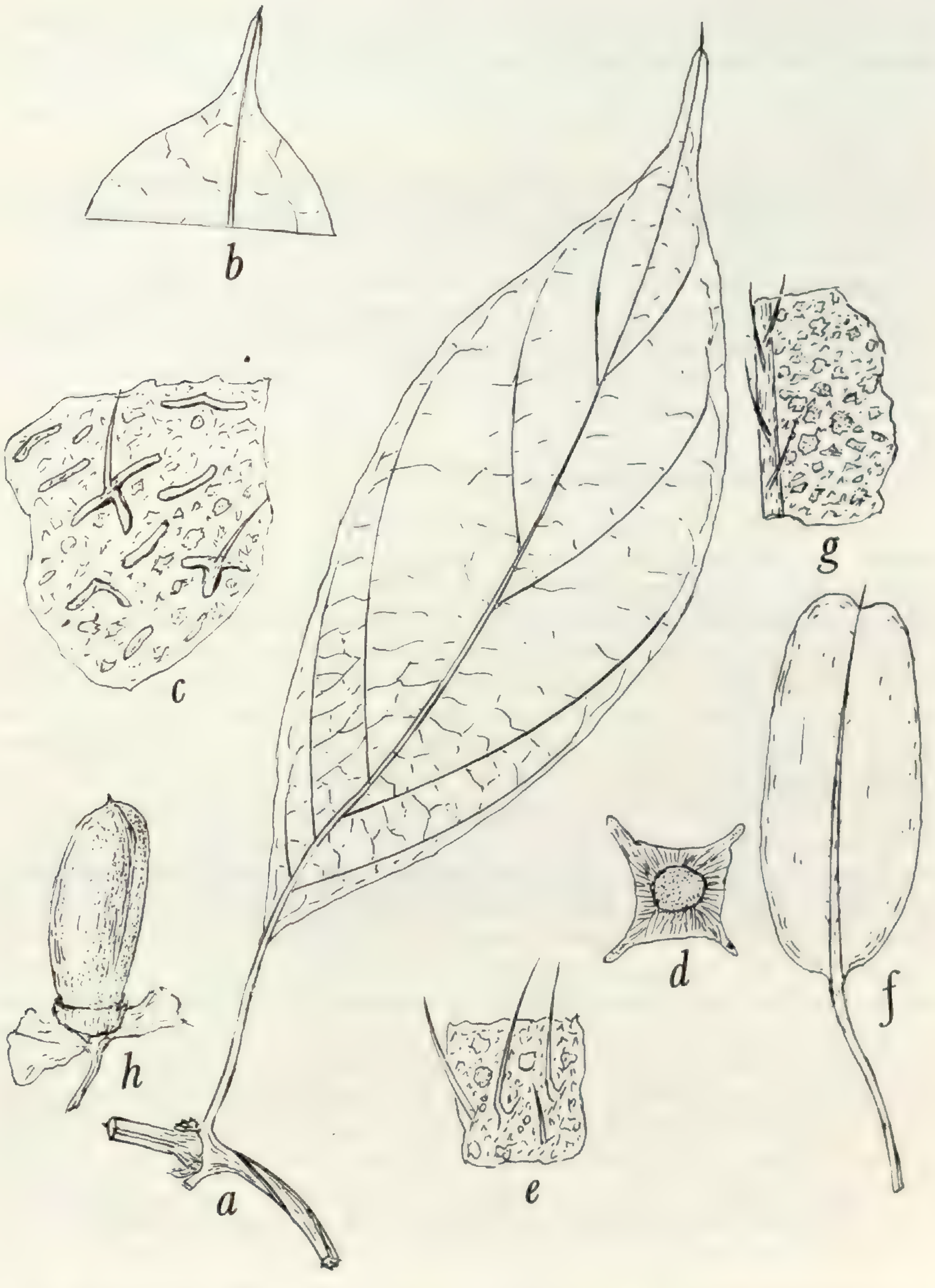

FIG. 28. *Mendoncia tetragona* Leonard, (*von Sneidern A. 194*). a, Node with leaf; b, tip of one of the uppermost leaf blades; c, small portion of leaf blade (upper surface) enlarged to show cystoliths; d, cross section of stem; e, small portion of stem (just above node) enlarged to show hairs; f, bract; g, small portion of bract (outer surface); h, drupe.

tip, (the point 1 to 1.25 mm. long) rounded at base, minutely muricate without, the costa sparingly strigose, glabrous within, corolla not seen; drupe oblong, 15 mm. long, 8 mm. wide, 7 mm. thick (dry), rounded at tip and slightly if at all oblique, minutely and inconspicuously muricate, the cupule 2.5 mm. high.

Type in the herbarium of the Riksmuseet, Stockholm, collected in forest along the Río Juradó, Chocó, Colombia, altitude 100 meters, September 11, 1940, by Kjell von Sneidern (No. A. 194).

Mendoncia tetragona is probably related to *M. glabra* Poepp & Endl. The original description was based on material collected in Peru. The quadrangular narrowly winged stems and the slender pedicels are similar in the two species, but the bracts of *M. glabra* are strictly ovate and acute and the drupes are subglobose.

21a. **Mendoncia caquetensis** Leonard, sp. nov. Fig. 29.

Planta volubilis, caulibus subquadrangularibus, sulcatis, parce lepidotis, glabris, vel ad nodos parce strigosis; lamina foliorum ovata, abrupte acuminata apice aristata, base abrupte acuta, aliquanto membranacea, integra, supra glabra, cystolithis rectis vel angularibus, subtus glabra, costa et venis venulisque crasse reticulatis parce strigosis exceptis, petioli longi, glabri vel in canalibus parce hirsuti; flores (1–3) axillares; pedicelli torti, parce hirtellis; bracteae ovatae, apiculatae externe minute muricatae, parce hirsutae, pilis rigidis, subadpressis, intus glabrae, minute rugosae; corolla glabra.

Tall climbing liane; stems subquadrangular, grooved, sparingly lepidote (the scales stellate), glabrous or bearing a few hairs at the nodes, these appressed, up to 0.25 mm. long; leaf blades ovate, up to 12 cm. long and 8 cm. wide, abruptly acuminate, the tip itself aristate, the awn up to 1.5 mm. long, the base of the leaf blades abruptly acute, the blade itself rather thin, entire, the upper surface glabrous, bearing minute straight or L-shaped cystoliths, the lower surface glabrous or the costa and lateral veins bearing a few scattered stiff straight ascending hairs up to 0.25 mm. long, the venation (lateral veins 4 or 5 pairs, veinlets coarsely reticulate) prominent beneath, less so above; petioles 3 to 4 cm. long, glabrous or the channels sparingly hirsute with straight ascending hairs about 0.16 mm. long; flowers axillary, 1 to 3 in each axis, the pedicels 15 to 17 mm. long, twisted, sparingly hirtellous, the hairs upwardly appressed, straight, rigid, mostly up to 0.25 mm. long, the bracts ovate, apiculate, the point about 0.75 mm. long, the outer surface minutely muricate and sparingly hirsute, the hairs straight, rigid, upwardly apressed, up to 0.32 mm. long, the costa rather prominent, the inner surface glabrous, minutely rugose; corolla white (?), glabrous, 3 cm. long, the tube 4 mm. broad at base, narrowed to 2.5 mm. at 10 mm. above base, the throat 6 mm. broad, the upper lip about 1 cm. long, the lobes rounded, the lower lip somewhat shorter than the upper.

Type in the herbarium of the Riksmuseet, Stockholm, collected in forest

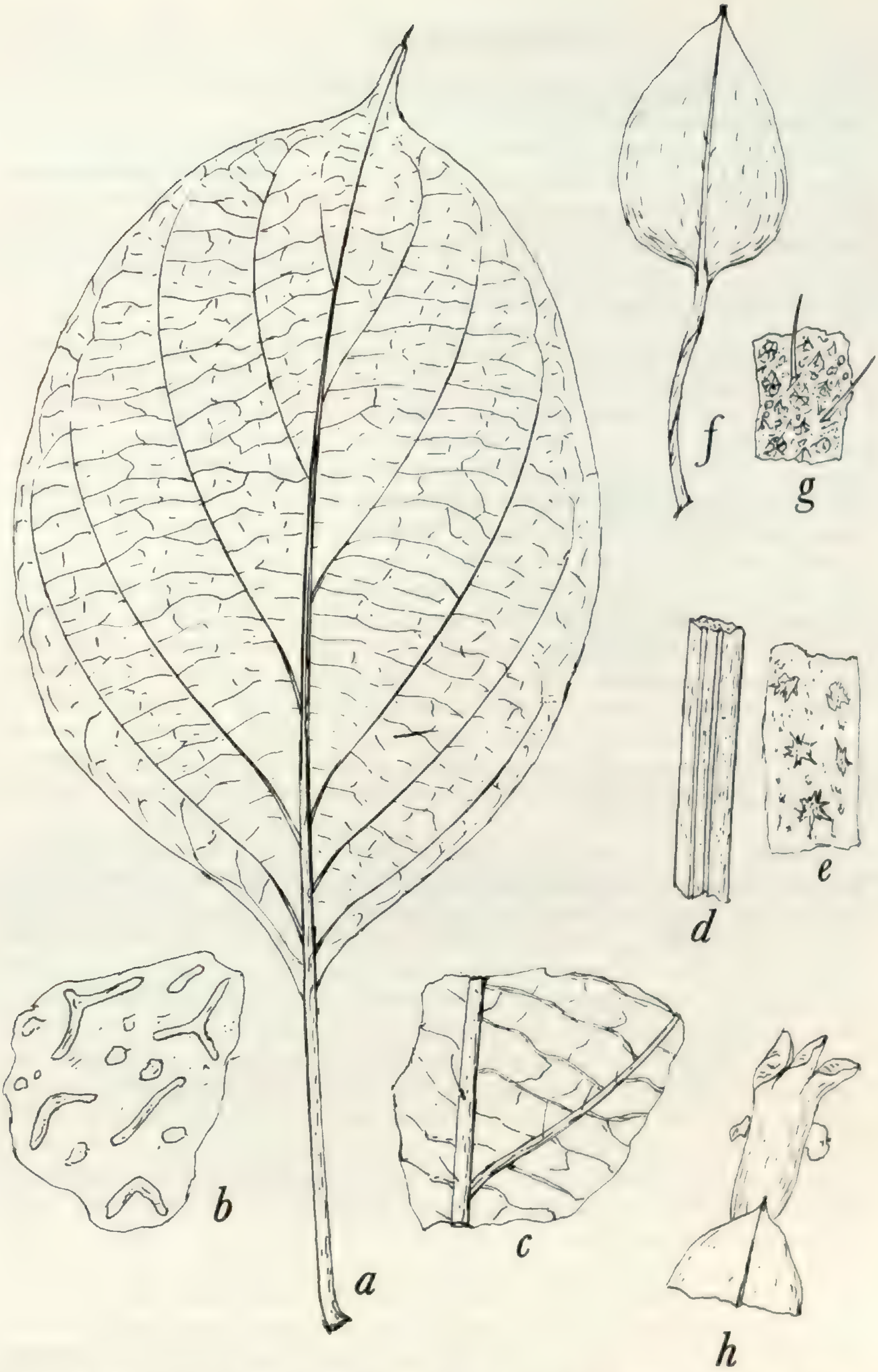

FIG. 29. *Mendoncia caquetensis* Leonard, (*von Sneidern A. 1088*). a, Leaf; b, small portion of the upper surface of the leaf blade enlarged to show cystoliths; c, portion of the lower surface of a leaf blade enlarged to show venation; d, section of stem enlarged to show grooves; e, small portion of stem enlarged to show stelliform cystoliths; f, bract; g, small portion of the outer surface of the bract enlarged to show hairs and minute spiculate excrescences; h, portion of corolla extending beyond bract.

at Morelia, Caquetá, Colombia, altitude 150 meters, October 7, 1941, by Kjell von Sneidern (No. A. 1008).

Mendoncia caquetensis is closely related to *M. odorata* Leonard, found in the departments of Cundinamarca and Boyaca. This species, however, has relatively thicker and narrower (up to 5 cm. wide) leaf blades and more densely hirtellous stems, leaves and bracts.

27a. **Aphelandra hylaea** Leonard, sp. nov. Fig. 30.

Suffrutex, caulibus teretibus, deorsum glabris, sursum strigosis; laminae foliorum plerumque patulae, anguste ellipticae vel ovato-lanceolatae, apice acutae vel subacuminatae (apice ipso obtuso vel rotundato) basi cuneatae, aliquanto firmae, integrae vel leviter crenatae, utrinque glabrae vel subtus in costa et venis lateralibus plus minusve strigosae; petioli breves, in canalibus strigosi; spicae densae, solitariae et terminalis vel plures, deinde terminales, et subterminales, rhache hirsuta; bracteae erectae, imbricatae, rhombeo-ovatae, acutae et minute apiculatae, deorsum angustatae, puberulae, costa et nervis lateralibus prominentibus, venulis crasse reticulatis, dentibus gracilibus spiniformibus, ascendentibus; ocelli minuti, depressi; bracteolae anguste triangulares, apice subulatae, carinatae, marginibus tenuibus, parce hirtellae, pilis albis; flores multae; calycis segmenta lanceolata, graciliter acuta, striata, apice parce strigosa, deorsum glabra; corollae erectae vel ascendentes, rubrae, apice parce puberulae, deorsum glabrae, labio superiore anguste ovato, acuto, labio inferiore trilobato, lobis profunde divisis, oblanceolatis, acutis; stamina vix exserta; ovarium glabrum.

Shrubby, up to 1 meter high or more; stems terete, glabrous or the upper portion strigose, the hairs upwardly appressed, up to 0.25 mm. long; leaves mostly spreading, the blades rather narrowly elliptic or ovate-lanceolate, up to 13 cm. long and 4.5 cm. wide, acute or subacuminate, the tip itself obtuse or rounded, cuneate at base, usually narrowly so, rather firm, entire or shallowly crenate, both surfaces glabrous except the costa and lateral veins (9 or 10 pairs), these more or less strigose, the hairs up to 0.25 mm. long; petioles 5 to 15 mm. long, the channels strigose, glabrous below; spikes dense, solitary and terminal or several, then terminal and subterminal, up to 14 cm. long and 4 cm. broad, the rachis hirsute, the hairs fine and spreading or ascending, up to 0.25 mm. long; bracts erect, imbricate, rhombic-ovate, 27 mm. long, 11 mm. wide at middle, acute to subobtuse and minutely apiculate at tip, narrowed from middle to a base 3 mm. wide, the costa and 3 pairs of lateral nerves rather prominent, the veinlets coarsely reticulate, the marginal veinlets terminating in a series of spikelike teeth up to 3.5 mm. long, the teeth ending about 8 mm. below the tip of the bract, the outer surface of the bracts puberulous with spreading or ascending hairs up to 0.16 mm. long, the inner surface glabrous or puberulous at tip and margins, the ocelli minute, forming an oval, depressed area about 1.5 mm. long and 1 mm. wide, darker than the surrounding surface

FIG. 30. *Aphelandra hylaea* Leonard. (*von Sneidern A. 1370*). a, Spike; b, node and leaf; c, portion of leaf margin enlarged to show the shallow crenulation; d, bract enlarged to show details; f, marginal portion of bract; e, marginal portion of bract enlarged to show details; f, bractlet; g, posterior segment of calyx; h, one of the lateral segments of the calyx; i, one of the anterior bracts of the calyx; j, corolla.

of the bract; bractlets narrowly triangular, 9 mm. long, gradually narrowed from base to a slender subulate tip, 2.5 mm. wide at base, carinate, the margins thin, rather sparingly hirtellous, the hairs white, straight or slightly curved, ascending, up to 0.25 mm. long; flowers numerous; calyx 12 mm. long, the posterior segment 3 mm. wide, the anterior pair 1.75 mm. wide, the lateral pair 1.25 mm. wide, all lanceolate, slenderly acute, striate, glabrous or bearing a few rigid ascending hairs up to 0.25 mm. long; corollas erect or ascending, 5.3 cm. long from base to tip of upper lip, red, glabrous below, sparingly puberulous above, the hairs slender, mostly straight and spreading, up to 0.16 mm. long, the corolla tube 2 mm. wide at base, enlarged gradually to 5 mm. at tip, the upper lip erect, narrowly ovate, acute, 17 mm. long, about 8 mm. wide, the lower lip spreading, 15 mm. long, 3-lobed, the lobes divided nearly to base, oblanceolate, about 4 mm. wide, acute; stamens reaching to within 3 mm. of the tip of the upper corolla lip and partly enfolded by it, the anthers oblong, 5.5 mm. long, 1.25 mm. broad, glabrous, the filaments glabrous; ovary glabrous.

Type in the herbarium of the Riksmuseet, Stockholm, collected in forest at Morelia, Caquetá, altitude 150 meters, November 26, 1941, by Kjell von Sneidern (No. 1370).

Aphelandra hylaea is related to *A. impressa* and even more closely to *A. lamprantha* Leonard. All three species agree in having the glandular area of the bracts made up of numerous minute ocelli and sunk in a depression. *A. impressa* is characterized by the long slender recurved tips of the bracts and by the long erectly ascending leaves (up to 28 cm.). The bracts of *A. lamprantha* and *A. hylaea* are erect and merely acute at tip and very similar, differing mostly in their width, up to 11 mm. in *A. hylaea* and 7 mm. in *A. lamprantha*. The leaves of *A. lamprantha* are close to those of *A. impressa* but narrower and like it, strongly ascending. The leaves of *A. hylaea*, on the other hand, are more or less spreading and short-petioled. The following key may serve to separate the three species:

Leaves mostly erect or sharply ascending, up to 28 cm. long and 6 cm. wide, more or less puberulous
  Tips of the bracts slender and recurved ..... *A. impressa.*
  Tips of the bracts erect, acute ..... *A. lamprantha.*
Leaves more or less spreading, up to 16 cm. long and 4.5 cm. wide, glabrous or nearly so ..... *A. hylaea.*

Cuatrecasas No. 7456, Vaupés, and *No. 11007*, Putumayo, cited under *Aphelandra impressa* Lindau (Contr. U. S. Nat. Herb. 31: 176. 1958) should be assigned to this species. The specific epithet is from the Greek ὑλαῖος, belonging to the forest. *Kjell von Sneidern No. A. 1300* is a depauperate specimen of *A. hylaea*. The sunken minute ocelli of this specimen are inconspicuous and poorly developed.

41a. **Aphelandra ameleta** Leonard, sp. nov. Fig. 31.

Frutex, caulibus dense hirsutis, pilis albidis ascendentibus; lamina foliorum oblongo-elliptica vel oblongo-obovata, breviter acuminata, basi

FIG. 31. *Aphelandra ameleta* Leonard, (*von Sneidern s.n.* XI-22-1941). a, Tip of plant; b, portion of leaf blade (lower surface) enlarged to show pubescence; c, same (upper surface) to show pubescence and venation; d, small portion of leaf blade (upper surface) much enlarged to show minute alveolate markings; e, bract; f, bractlet; g, posterior segment of calyx; h, one of the anterior segments; i, one of the lateral segments.

cuneata, firma, leviter crenata, supra glabra et nitida, in costa strigosa, subtus dense et molliter hirsuta, pilis pallide brunneis, ascendentibus; petioli breves, crassi, dense hirsuti; spicae terminales, pedunculo brevi, crasse, dense hirsuto, rhache dense puberula, pilis ascendentibus pallide brunneis; bracteae ovatae, subobtusae, basi cuneatae, subtiliter striatae, integrae, firmae, marginibus integris, subhyalinis, externe subtiliter et inconspicue puberulae, intus glabrae, costa et nervis (3 paribus) inconspicuis striatis occultis, venulis in marginibus arcte reticulatis; ocelli nulli; bracteolae anguste ovatae vel lanceolatae, graciliter acutae, externe minute puberulae, intus glabrae et nitidae, subcarinatae, striatae, firmae, marginibus subhyalinis; calycis segmenta lanceolata, striata, externe minute puberula, intus glabra, marginibus subhyalinis, segmentum posterius apice acutum, anteriora et lateralia apice acuta et aristata; corolla alba; ovarium glabrum.

Shrubs up to 3 meters high; stems, at least the tips, densely hirsute, the hairs whitish, ascending, up to 1 mm. long; leaf blades oblong-elliptic or oblong-obovate, 40 cm. long and 10 cm. wide or more, briefly acuminate, cuneate at base, firm, shallowly crenate, the upper surface glabrous and nitid except the costa, this strigose, the hairs up to 0.75 mm. long, the lower surface densely and velvety hirsute, the hairs light brownish, ascending, up to 1 mm. long; petioles 3 mm. thick, 1.5 cm. long, densely hirsute, the hairs similar to those of the stems; spike terminal, 20 cm. long, 2 cm. broad, the peduncle 1 cm. long, 4 mm. thick, densely hirsute like the stem, the rachis densely puberulous with ascending light brownish hairs up to 0.25 mm. long. bracts ovate, up to 28 mm. long and 12 mm. wide, subobtuse, 5 mm. wide at base, finely striate, entire, firm, with a narrow subhyaline nerveless margin, the outer surface finely and inconspicuously puberulous, the hairs up to 0.1 mm. long, the inner surface striate and glabrous, the costa and about 3 pairs of lateral nerves inconspicuous, hidden by the striations and, near the margins, the closely reticulated veinlets; ocelli none; bractlets narrowly ovate or lanceolate, 12 mm. long, 3.5 mm. wide, slenderly acute, minutely puberulous without, glabrous and nitid within, subcarinate, striate, firm, with a narrow subhyaline margin; calyx 14 mm. long, the posterior segments 5.5 mm. wide, acute or lacerate (?), the posterior segments 2.5 mm. wide, acute and aristate at tip, the lateral segments 2 mm. wide, acute and aristate, all of the segments lanceolate and striate with subhyaline nerveless margins, minutely puberulous without and glabrous within; corolla white (*von Sneidern*); ovary glabrous.

Type in the herbarium of the Riksmuseet, Stockholm, collected in forest at Morelia, Caquetá, Colombia, 150 meters altitude, November 22, 1941, by Kjell von Sneidern (s.n.).

In relationship *Aphelandra ameleta* is nearest *A. arisema* Leonard but at best only distantly so. The spike of the holotype was badly eaten by insects. The specific name is a Greek word, ἀμέλητος meaning neglected and used in the same sense as the Latin word *neglecta*.

52a. **Aphelandra monophthalma** Leonard, sp. nov. Fig. 32.

Herba vel suffrutex, caulibus subteretibus, deorsum glabris, sursum strigosis, pilis sursum appressis albidis, nitidis; lamina foliorum oblongo-elliptica vel leviter oblongo-obovata, apice breviter acuminata (apice ipso subobtuso, plus minusve curvato), costa in parvum mucronem terminata, basi angustata, aliquanto firma, integra vel leviter crenata, supra glabra, in costa et venis lateralibus strigosis, subtus parce strigosa, in costa et venis lateralibus dense strigosa; petioli breves, dense strigosi; spicae plus minusve graciles, solitariae et terminales, vel plures, deinde terminales et subterminales, pedunculo brevi, rhache dense pubescente, pilis albidis, adpressis vel ascendentibus; bracteae rhombeo-ovatae, acutae, costa in parvum mucronem terminante, externe puberulae, intus glabrae vel apice puberulae, utrinque pilis appressis, costa prominente, nervis lateralibus obscuris; ocelli nitidi, lucidi, solitarii, interdum multi, interdum nulli; bracteolae lanceolatae, carinatae dorso strigosae, pilis albidis, ascendentibus, in marginibus glabrae et subhyalinae; calycis segmenta lanceolata, acuminata, striata, externe minute puberula, intus glabra; corolla rubra, subtilliter lepidota, squamis minutissimis, triangularibus acutis, basi glabra excepta, labio superiore ovato, apice bilobato, lobis triangulis, acuminatis, labio inferiore trilobo, lobo medio patulo, anguste ovato, acuminato, apice acutissimo, lobis lateralibus parvis, oblongis, obtusis, cum labio superiore pro parte connatis; stamina exserta; ovarium glabrum.

Herbs or shrubs up to 2.5 meters high; stems subterete, glabrous below, strigose near tip, the hairs upwardly appressed, up to 0.08 mm. long, slender, whitish, nitid, giving a silky sheen to stem; leaf blades oblong-elliptic or slightly oblong-obovate, up to 26 cm. long and 8.5 cm. wide, gradually narrowed to a rather short-subacuminate tip (the tip itself subobtuse and often more or less curved) the costa terminating in a very short mucro, gradually narrowed at base and decurrent on the petiole, moderately firm, entire or shallowly crenate, the upper surface glabrous except the strigose costa and to a lesser extent the lateral veins (10 to 12 pairs), the lower surface sparingly strigose and the costa and lateral veins more densely strigose; petioles up to 3 cm. long, densely strigose, the hairs similar to those of the stem and costa; spikes rather slender, up to 16.5 cm. long and 8 mm. broad, the peduncles 5 to 10 mm. long and 2.25 mm. thick, strigose like the upper parts of the stems, the rachis densely pubescent except the concave cavities in which the flowers are partly imbedded, the hairs whitish, up to 0.08 mm. long, upwardly appressed or ascending; bracts rhombic-ovate, 7.5 to 8.5 mm. long, 4 to 4.25 mm. wide at 3 mm. above the base, acute, the costa prolonged into a short mucro 0.5 mm. long, the upper surface puberulous, densely so towards base, less so toward the apex, the inner surface glabrous and nitid except towards tip, here more or less puberulous, the hairs of both surfaces appressed, up to 0.08 mm. long, the margins veinless and ciliate, the hairs up to 0.16 mm. long, the costa prominent but the lateral nerves obscure, ocelli varnished, nitid, solitary, 1.5 mm. long and 1 mm. wide, sometimes 2 to several, these though closely

FIG. 32. *Aphelandra monophthalma* Leonard, (*Garcia-Barriga 13920*). a, Tip of plant; b, leaf; c, portion of leaf blade (upper surface) enlarged to show pubescence and veins; d, same (lower surface); e, same (lower surface) enlarged still more to show hairs and minute scurfy particles; f, bract; g, one of a pair of bractlets; h, posterior calyx segment; i, one of a pair of anterior calyx segments; j, one of a pair of lateral segments; k, corolla; l, small portion of corolla (outer surface) enlarged to show pubescence.

contiguous are well defined and smaller, 1 mm. long and 0.5 mm. wide, and again the ocelli may be lacking altogether or their location represented by an open place between the broken nerves; bractlets lanceolate, 8.5 mm. long, gradually narrowed into a slender subulate tip, carinate, strigose dorsally, the hairs, ascending, whitish, up to 0.24 mm. long, the margins glabrous and subhyaline; calyx 9 to 10 mm. long, the segments lanceolate, slenderly acuminate, striate with callouses at base, the outer surface minutely puberulous, the inner glabrous, the posterior segment 4 mm. wide, the anterior segments 2 mm. wide, the lateral 1 mm. wide; corolla red, 5 cm. long, minutely scurfy with small triangular flattish hairs about 0.03

mm. long, except the basal portion (up to 3 mm. above base), this glabrous, the corolla tube 2.5 mm. broad at base, enlarged to 3.5 mm. at 2.5 mm. above base, thence narrowed to 2 mm. at 7 mm. above base, then gradually enlarged to a cylindrical tube 5 mm. broad, the throat 6 mm. broad, the upper lip ovate, 2 cm. long, 6.5 mm. wide, 2-lobed at tip, the lobes triangular, 7 mm. long and 3 mm. wide at base, slenderly acute, the lower lip more or less spreading, 18 mm. long, the middle lobe lanceolate, cleft to base of lip, 6 mm. wide, acuminate, the lateral lobes 5 mm. long, their upper margin attached to the upper corolla lip, the free portion triangular, about 1 mm. long and broad, obtuse; stamens exserted about 1 cm. beyond the mouth of the corolla tube, the anthers oblong 7 mm. long, 1.25 mm. broad, glabrous or sparingly pilose dorsally, webby at tips; style slightly exceeding the stamens, minutely 2-lobed, glabrous; ovary glabrous.

Type in the U. S. National Herbarium, No. 2057242, collected along the Río Apaporis, between the rivers Kananarí and Pacoa, Amazonas-Vaupes, Colombia, 250 meters altitude, December 1–15, 1951 by H. Garcia-Barriga (No. 13920); Garcia-Barriga No. 13926 is also of this species.

Aphelandra monophthalma is closely related to *A. daemonia* and like it producing a predominance of bracts with a solitary ocellus. The leaves of *A. daemonia* are, however, more abruptly narrowed into a long winged petiole and, though sparingly so, appressed hirsute on both surfaces. The bracts, too, are shorter and relatively broader (5 mm. long and wide) and obtuse or only subacute.

The paratype of *A. monophthalma* differs in several respects from the holotype. In the paratype we have a herb with a single terminal and slightly broader spike and the bracts also slightly broader than those of the holotype. Both specimens were collected in the same region and on the same date and at the same altitude.

The specific epithet is from the Greek *μονος* one and *ὀφθαλμός* eye, in allusion to the presence of bracts with but a single ocellus.

22a. **Pseuderanthemum leptostachys** Leonard, sp. nov. Fig. 33.

Herba grandis, caulibus subteretibus, glabris vel sursum bifariam puberulis, pilis brevibus, curvatis, albis, articulatis; lamina foliorum oblonga, breviter acuminata, basi subpanduriformis, obtusa vel subcordata, valde crispata, utrinque glabra, subtus costa et venis lateralibus et venulis crasse reticulatis aliquanto prominentibus, supra plus minusve obscuris, cystolithis pluribus; petioli breves, crassi; spicae graciles, 2–4 pedunculum terminantes, simplices vel parce ramosae, patulae vel pendulae; pedunculi bifariam puberuli; rhaches planae puberulae; bracteae subulatae, puberulae; bracteolae parvae, bracteis breviores; calycis segmenta lineari-lanceolata, membranacea, pallide brunnea, parce puberulenta; corolla alba (?), glabra, labio superiore erecto, ovato, apice rotundato, labio inferiore 3-lobato, patulo, lobis ovatis, rotundatis; stamina vix exserta; ovarium puberulum, pilis glandulosis.

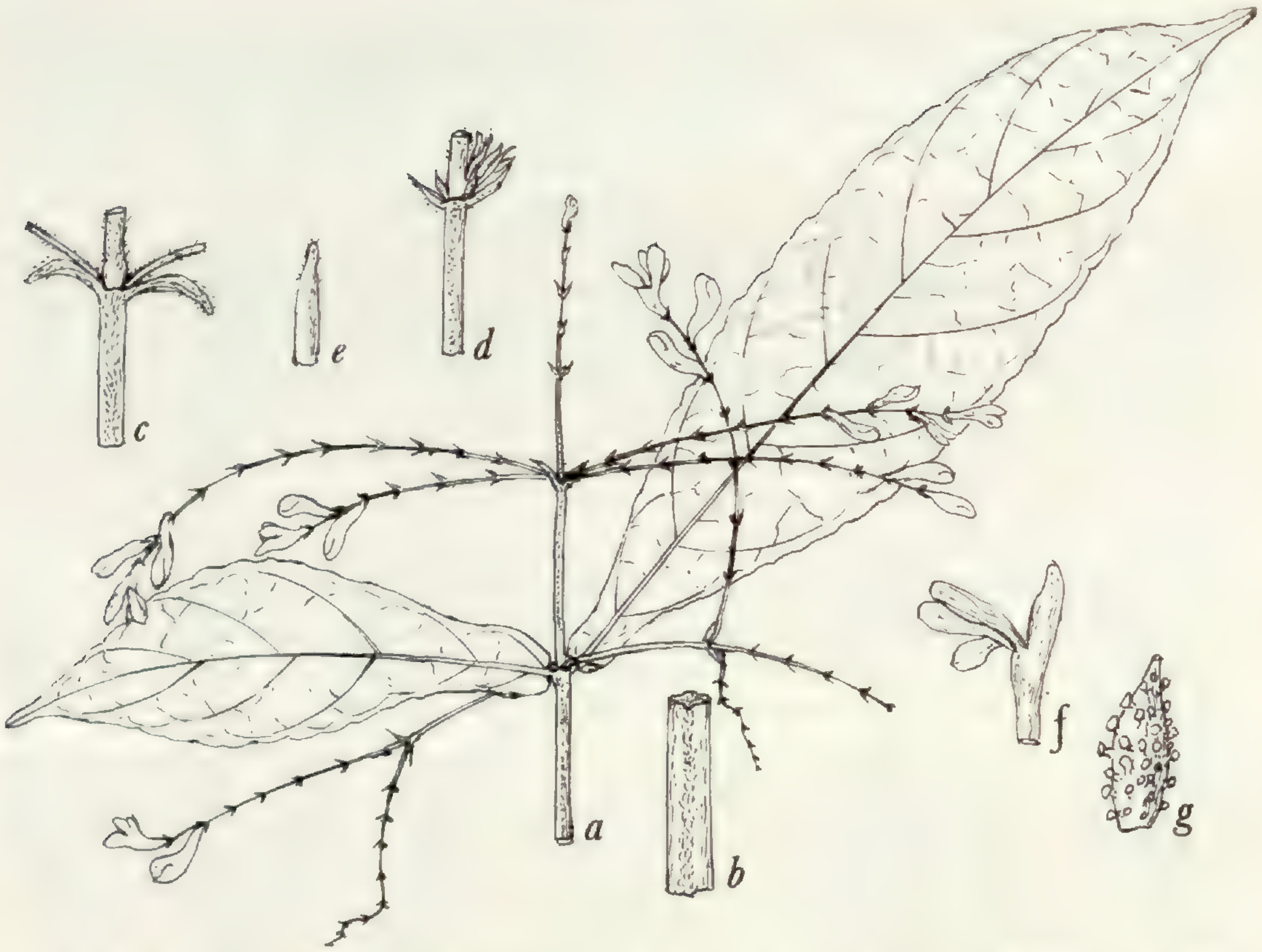

FIG. 33. *Pseuderanthemum leptostachys* Leonard, (*von Sneidern 5710*). a, Tip of plant; b, portion of stem enlarged to show bifarious pubescence; c, lowermost node of rachis to show bracts; d, one of the nodes of a rachilla showing bracts, bractlets and calyx; e, one of the calyx segments; f, corolla; g, ovary.

Large herbs; stems subterete, glabrous or the upper portions bifariously puberulous, the hairs up to 0.4 mm. long, curved in various directions, mostly spreading, white and rather conspicuously jointed; leaves subsessile, the blades oblong, up to 18 cm. long and 7 cm. wide, rather abruptly and briefly acuminate, panduriform at base, obtuse or subcordate and strongly crisped, both surfaces glabrous, the margins crenate, the costa and lateral veins (about 6 pairs) and the coarsely reticulated veinlets rather prominent beneath, obscure above, the cystoliths numerous, mostly straight, and 0.08 to 0.24 mm. long, the lower surface of the blades under high magnification, minutely alveolate and nitid, the upper surface similar to the lower but the alveolar markings not so conspicuous; petioles 2 mm. long and 1.5 mm. thick, glabrous; flowers borne on slender, simple or sparingly branched spikes up to 5 cm. long, these terminating peduncles up to 2 cm. long, spreading or slightly drooping, the peduncles bifariously puberulous, the hairs similar to those of the stems, the rachises flattened, puberulous, the hairs spreading or ascending, up to 0.112 mm. long, the peduncle of the spikes 1 cm. long, the lowermost internode 5 mm. long, gradually becoming shorter toward the tip; bracts subtending the spikes 3 mm. long and 0.5 mm. wide, firm, puberulous, subacute; bracts subtending the flowers subulate, the lowermost pair 2.5 mm. long, triangular in cross section, about

0.5 mm. broad, successively smaller toward the tip of the spike, all puberulous; bractlets linear, 1.5 mm. long, 0.25 mm. wide, subobtuse, minutely hirtellous dorsally; calyx segments linear-lanceolate, 1.5 mm. long, 0.5 mm. wide at base, thin, light brown, sparingly puberulous; corolla white (?), glabrous, 8 mm. long (from base of tube to the tip of the upper lip), the tube 1.5 mm. broad, the throat 2.5 mm. broad, the upper lip erect, 4.5 mm. long, 1.5 mm. wide, ovate, rounded at tip, the lower lip spreading, 6 mm. long, 3-lobed, the lobes oval, 5 mm. long, 2.5 mm. wide, rounded at tip, stamens slightly exserted, the anthers 0.75 mm. long and 0.5 mm. broad; ovary glandular-puberulous.

Type in the herbarium of the Riksmuseet, Stockholm, collected at Quimarí, Cordillera Occidental, Vertiente Oriente, Department of Bolívar, Colombia, altitude 500 meters, March 15, 1949, by Kjell von Sneidern (No. 5710).

Pseuderanthemum leptostachys is possibly related to *P. Cuatrecasasii* Leonard. The two species resemble each other in their subpanduriform leaf blades, these being obtuse to rounded at the abruptly narrowed and strongly crisped or recurved bases.

The specific epithet is from the Greek λεπτός, graceful or slender and στάχυς, spike.

5a. **Justicia Schneideri** Leonard, sp. nov. Fig. 34.

Suffrutescens, caulibus subquadrangularibus, bifariam hirtellis, pilis retrorse curvatis, cystolithis pluribus parallelis; lamina foliorum rhomboidea, acuminata (apice ipso obtuso), basi cuneata, firma, integra, supra parce pilosa, subtus densius pilosis, pilis praecipue in costa et venis positis, cystolithis pluribus; petioli breves; spicae terminales et laterales, curvatae pedunculatae, pedunculis dense pilosis, pilis patulis vel retrorse curvatis; flores secundi; rhaches ambae pilosae et puberulae, internodiis brevibus; bracteae infimis foliaceae parvae dense pilosae, costa et venis lateralibus conspicuis; bracteae superiores parvae spathulatae, acutae, basi angustatae hirtellae et ciliatae; bracteolae parvae lineares, acutae, ambae pilosae et puberulae; calycis segmenta 4, anguste lanceolata apice gracilia, quam bracteis longiora, puberula, pilis acutis et pilis glandulosis intermixtis; corolla rubra, puberula, tubo angusto, labio superiore erecto, ovato, rotundato, labio inferiore trilobato, lobis rotundatis; stamina vix exserta, lobis antherarum leviter superpositis, parallelis vel leviter obliquis, lobo inferiore breviter caudato; ovarium glabrum.

Shrubby, up to 30 cm. high or more, stem subquadrangular, bifariously hirtellous, the hairs retrorsely recurved, up to 0.16 to 0.3 mm. long or the upper portion bearing scattered spreading or ascending hairs up to 1 mm. long, these white and jointed, the cystoliths numerous, crowded and parallel, mostly 0.06 to 0.3 mm. long; leaf blades subrhombic, up to 7 cm. long and 3 mm. wide at or slightly below middle, acuminate, (the tip itself obtuse) narrowed at base, firm, entire, the upper surface of the mature blades sparingly pilose, the younger ones densely so, the hairs up to 0.32

FIG. 34. *Justicia Schneideri* Leonard, (*Schneider 473*). a, Node with spike and leaves; b, tip of plant showing terminal spike; c, portion of stem enlarged to show pubescence; d, portion of leaf blade (lower surface) enlarged to show pubescence; e, lowermost node of spike; f, bract; g, a bractlet; h, calyx; i, tip of calyx segment enlarged to show pubescence; j, portion of tip of calyx segment yet more enlarged to show pubescence in detail; k, tip of corolla; l, anther.

mm. long, white, more or less spreading to subappressed, the lower surface more densely pilose, the hairs similar to those of the upper surface but confined chiefly to costa and lateral veins (6 or 7 pairs), these prominent beneath, obscure above, the cystoliths numerous, and rather conspicuous especially those of the lower surface, slender, up to 0.25 mm. long; petioles 1 to 3 mm. long, the pubescence that of the stems; flowers subsecund on terminal and lateral spikes, these up to 3 cm. long, and 5 mm. wide, curved, the peduncles up to 1 cm. long, densely pilose with spreading to retrorse white hairs up to 1 mm. long, the lowermost pair of bracts foliaceous, 1 cm. long, 2 mm. wide, densely pilose, the hairs of the lower surface confined chiefly to the costa, the lateral veins conspicuous, crowded, giving the bract a striate appearance, the rachis both pilose and puberulous, the small hairs spreading or retrorse, and up to 0.08 mm. long, the internodes of the rachis 4 mm. long, becoming shorter toward the tip of the spike; bracts spathulate, 5 mm. long, 1.25 mm. wide above middle, acute, gradually narrowed to a 0.75 mm. wide base, both surfaces hirtellous with hairs up to 0.25 mm. long except at the margins, these ciliate with spreading hairs up to 1 mm. long; bractlets linear, 3.5 mm. long, 0.5 mm. wide, both acute, pilose and puberulous; calyx segments 4, 4 to 6 mm. long, narrowly lanceolate, narrowed into a slender subulate tip, puberulous, the hairs, both acute and glandular, mostly spreading and 0.08 mm. long, these towards the tips of the segments intermixed with a few longer acute hairs about 0.25 mm. long; corolla red, puberulous, the hairs spreading to retrorsely

curved, up to 0.15 mm. long, the tube 1.5 mm. broad at base, gradually enlarged to 4 mm. at throat, the upper lip erect, ovate, 7 mm. long and 4 mm. wide just above the base, rounded at tip, the lower lip more or less spreading, 3-lobed, the lobes oval, about 4 mm. in diameter, rounded; stamens slightly exserted, the anther lobes 1.5 mm. long, 0.5 mm. broad, one attached slightly above the other, the lower one apiculate at base, glabrous except the dorsal ridge, this puberulous, the filaments flat, glabrous; pistil slightly longer than the stamens, the stigma minute; ovary glabrous.

Type in the herbarium of the Riksmuseet, Stockholm, collected in thicket at Quesame, Guayabetal, Cundinamarca, Colombia, 1500 meters altitude, December 17, 1947, by Martin Schneider (No. 473).

Data on type label: "Strauchig. Blüten rot. Dep. Cundinamarca. Fundort Quesame, Guayabetal, 1500 m. Im dichten bebüsch." *Justicia Schneideri* apparently, has no close relatives in Colombia.

40. JUSTICIA FILIBRACTEOLATA Lindau (Page 577).

CALDAS: Santa Cecilia, Tatamá, altitude 800 meters, *von Sneidern 4989* (S); *5098* (S).

In my description of this species (Contr. U. S. Nat. Herb. 31: 578. 1958), the range of length of the corolla is much too large. Line 19 down should read "corolla 2 cm. long" instead of "corolla 2 to 4 cm. long." The following 4 specimens cited on page 579 of the same work should have been determined as *Justicia secunda* Vahl: *Fernández 350*, *Haught 4772* and *4773* and *Killip & Smith 17031*. The calyxes of *J. filibracteolata* usually bear at least a few glandular hairs, intermixed with the acute ones.

57. JUSTICIA COMATA (L.) Lam. (Page 615).

EL VALLE: Cordona, *von Sneidern 4601* (S).

The following key may serve to separate *Justicia pectoralis* Jacq. and *J. comata* (L.) Lam. more readily than that section based exclusively on the presence or absence of glandular hairs in Contr. U. S. Nat. Herb. 31: 492. 1958.

Corolla 4 to 10 mm. long; inflorescence terminal, the branches usually few, alternate, the rachises evenly and densely puberulous with both acute and glandular hairs, the internodes 5 to 10 mm. long ..... *J. pectoralis.*

Corolla 3 to 4 mm. long, the inflorescence both terminal and axillary or sometimes terminal only, the panicles peduncled, the branches filiform and usually numerous, those of the terminal inflorescence verticillate on the main axis, those of the lateral panicles often umbellate, the rachises usually glabrous or occasionally sparingly puberulous with either acute or glandular hairs or both, the internodes 1 to 5 mm. long ..... *J. comata.*

United States National Museum
Smithsonian Institution
Washington, D. C.

Ivan Murray Johnston

(1898–1960)

At the time of his death on May 31, 1960, Dr. Ivan Murray Johnston was planning to retire from Harvard University and join the staff of Texas Research Foundation in September, 1961. He had essentially completed the family Boraginaceae for the FLORA OF TEXAS, which is to be published during 1961. Dr. Johnston's science library is now a part of the library of Texas Research Foundation.

At intervals, from 1957 through 1959, Dr. Johnston aided the staff of Texas Research Foundation in its botanical exploration of Texas and northern Mexico. The more than 5,000 numbers which he helped to collect during this period are housed in the herbarium at Renner.

NOTES ON SOME TEXAN BORAGES[1]

IVAN M. JOHNSTON

Coldenia gossypina (Woot. & Standl.) Johnston, comb. nov.

Eddya gossypina Woot. & Standl., Contr. U. S. Nat. Herb. 16: 164. 1913 and Contr. U. S. Nat. Herb. 19: [Fl. New Mex.] 537. 1915.

Type from Little Mt. [i.e. Torgugas Mt.], southeast of Las Cruces, Dona Ana Co., New Mexico., Sept. 2, 1894, *E. O. Wooton.*

This species has been confused with *C. hispidissima* (T. & G.) Gray. Most of its range is in northern Mexico (in Coahuila and eastern Chihuahua). In the United States it is known only from the southern half of Brewster County, Texas, and from thence northwestward along the Rio Grande valley to the vicinity of El Paso and (about 40 miles beyond) to the vicinity of Las Cruces in adjacent New Mexico. *Coldenia hispidissima*, on the other hand, is a northern species. It is widely distributed in New Mexico and enters trans-Pecos Texas from the north and northwest and there reaches its southern limit. In Texas and New Mexico it is much more common and very much more widely and generally distributed than is *C. gossypina*. Both species have been collected in and along the Rio Grande valley. Only there have they been found sharing the same general area. Both species grow on gypsum or gypseous soils and, if not invariably

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so, at least usually are confined to that kind of substratum. The two species may be contrasted as follows:

Foliage usually cinereous; leaf-blade lanceolate, evidently broader than the base of the petiole, lower surface only partially covered by the loosely revolute leaf-margin; calyx-lobes with the midrib not thickened; corolla in the bud minutely glandular, otherwise glabrous; vein on the corolla-tube below the stamen-attachment winged; nutlet with the attachment-scar closed or open only above the middle; Rio Grande Valley south into Mexico.....*C. gossypina.*

Foliage usually green; leaf-blade usually linear, narrower than the broad indurate base of the petiole, tightly revolute leaf-margin covering all the lower leaf-surface except the midrib; calyx-lobes with thickened midrib; corolla in the bud villulose, not glandular; vein on the corolla-tube below the stamen-attachment not winged; nutlet with the attachment-scar broadly open especially below the middle; trans-Pecos Texas and north in New Mexico. .....*C. hispidissima.*

Coldenia mexicana Wats. var. **tomentosa** (Watson) Johnston, comb. nov.

Coldenia tomentosa Watson, Proc. Am. Acad. 18: 120. 1883.

Type from the mountains south of Saltillo, Coahuila, *Palmer 864.*

In Texas this variety is known only west of the lower Pecos, in southern Val Verde and Terrell counties. From here it ranges south in the eastern portions of Coahuila. It now seems probable that the type was collected at the base of the Sierra de Parras south of General Cepeda. The only sharp, decisive character to separate this variety from typical *C. mexicana* is provided by the trichomes on the corolla-bud. Since these differences are associated with plants occupying different geographical areas and having, perhaps, slightly different habit, I have considered them worthy of varietal recognition.

The var. *tomentosa* has the corolla-bud distinctly villulose and not at all glandular, or villulose and only very sparsely and inconspicuously glanduliferous. In addition, its corollas appear to average slightly smaller than those of the typical form, and its older stems tend to be somewhat more fruticulose.

The typical form of the species is known in Texas only in the Big Bend and from there extends south and southeast across Coahuila. In the bud the corolla is abundantly but minutely glanduliferous, but otherwise glabrous. The type was collected by Edw. Palmer (No. 872) "in the mountains east of Saltillo", Coahuila. Since both the species and the variety are usually found only on or in the vicinity of Upper Cretaceous beds, it seems likely that the actual place of collection was at the base of the mountains. Under *C. mexicana* when he proposed the species, Watson also cited *Edw. Palmer no. 875 in pt.* from Monclova, Coahuila, a collection which had been received mixed with material of *C. canescens* DC. This material is to be excluded from typical *C. mexicana*. It is representative of the var. *tomentosa*.

Cryptantha Paysonii (Macbride) Johnston, comb nov.

Oreocarya Paysonii Macbride, Contr. Gray Herb. 48: 36. 1916.

Type from limestone hills, Berrendo Creek, Sierra Co., New Mexico, May 12, 1905, *O. B. Metcalfe 1576*.

Hemisphaerocarya Paysonii (MacBride) Brand in Fedde, Repert. Sp. Nov. 24: 61. 1927.

NEW MEXICO: DeBaca County, (southern part of county?) rolling hills on divide betw. Roswell and Vaughn, along highway about 60 mi. north of Roswell, May 2, 1948, *L. C. Hinckley 4377* (US). Otero County, Guadalupe Rim, near Orange, near Texas boundary west of Guadalupe Mts. steep limestone slope, April 21, 1929, *M. W. Talbot 960* (GH). Sierra County, Berrendo Creek, limestone hills, May 12, 1905, *O. B. Metcalfe 1576* (US); Lake Valley, limestone hills, Sept. 1914, *Mrs. Ida M. Beals* (US); Lake Valley, 1915, *Mrs. W. G. Beals* (US).

TEXAS: Culberson County, head of Guadalupe Pass, along Hwy. 180, rocky soil, corolla white with yellow throat, May 16, 1959, *D. S. Correll & I. M. Johnston 22003* (LL); Guadalupe Mts., a mile west of Pine Springs, along Hwy. 180, frequent, root with purple dye, alt. 6500 ft., May 30, 1958, *B. H. Warnock & M. C. Johnston 16299* (SRSC); Apache Mts., about 3 mi. northwest of Kent, thin buff silty soil (Tansill formation), slope of low ridge about a half mile northeast of Gardner Ranch Hdq., June 21, 1949, *M. H. Janszen 81* (TEX).

This species has been confused with *C. oblata* (Jones) Payson, and included under that species in Payson's monograph of *Cryptantha* § *Oreocarya*, Ann. Mo. Bot. Gard. 14: 255. 1927. It differs most strikingly and is identified most easily by its very strongly heterostylic flowers. In *C. oblata* the corolla is uniformly monomorphic and its stamens are always borne near the middle of the corolla-tube and the style always is short and never surpasses them. In *C. Paysonii* the style may be long and nearly exserted from the corolla-tube. When so, stamens are always borne near the middle of the tube. When the style is short, reaching only halfway up the tube, then the stamens are always borne at the top of the corolla-tube with their tips somewhat exserted. The corollas of *C. Paysonii* are strongly and obviously dimorphic.

Some other characters distinguishing *C. Paysonii* from its relative are its finely rugose or finely tuberculate, rather than coarsely tuberculate nutlets, its densely puberulent rather than glabrous or nearly glabrous faucal appendages, and its generally somewhat larger corollas and nutlets. Its inflorescence tends to remain capitate and not become loose and thrysoid as is common in *C. oblata*.

In Culberson County, Texas, about the Guadalupe and Apache mountains, *C. Paysonii* has been found in the same area as *C. oblata*, but elsewhere it is known only in areas in New Mexico well to the north and northwest of the range of *C. oblata*. The latter is known in New Mexico only from eastern Dona Ana County to the east and southeast of Las Cruces, but is frequent and widely distributed in the western half of trans-Pecos Texas.

Cryptantha mexicana (Brandegee) Johnston, comb. nov.

Krynitzkia mexicana T. S. Brandegee, Zoe 5: 182. Aug. 1905.

Type from Viesca, Coahuila, 1903, *Purpus 126*.

This species has been confused with *Cryptantha albida* (H.B.K.) Johnston, but is readily distinguished from it by differences in habit of growth and its more bristly green herbage, larger proportionately broader fruiting calyces, and more elongate, conspicuously bracted cymes. It is a spring-flowering herb with several to many, dichotomously branching stems which are usually decumbent or widely ascending. *Cryptantha albida*, on the other hand, is a much taller, and more slender, summer-flowering herb. Its one to several stems form straight erect axes from which numerous lateral branches arise. Typical *C. albida* grows in western trans-Pecos Texas and southern Arizona and extends south through western Coahuila and eastern Chihuahua and Durango to central Mexico. The type came from Hidalgo. *Cryptantha mexicana*, however, is the common annual member of this genus in the large area from the vicinity of El Paso, Texas, and southeastern New Mexico, southeastward to the southern tip of Texas, and south across the Rio Grande to northern Nuevo Leon and southern Coahuila. It appears to affect warmer areas and generally lower altitudes than *C. albida*; unlike *C. albida*, which seems to be most common in volcanic areas, it seems to have a prevailing special preference for limestone soils.

The nomenclatorial history of the species is confused. The original description of *Krynitzkia mexicana* Brandegee, as between *Cryptantha albida* and the present species applies well to the latter. In addition to the type (Viesca, Coahuila, 1903, *Purpus 126*), another collection, *Pringle 8301* from "Diaz" (i.e. Piedras Negras), Coahuila, is also mentioned by the author of the species. Pringle's collection is very characteristic of *C. mexicana* as here accepted. However, the type collection now preserved at the University of California at Berkeley, is a mixture of recognizable *C. mexicana* and young plants of *Amblynotopsis heliotropioides* (A. DC.) Macbride. Since Mr. Brandegee's original description of *K. mexicana* does not apply to the *Amblynotopsis*, only the *Cryptantha* included under *Purpus 126* is considered as belonging to his species.

I have recognized the present species as distinct from *C. albida* for many years and over this period have reported many specimens of it to collectors under the name "*Cryptantha mexicana* (Brandg) Jtn." By oversight this combination was not properly published. In the meantime, however, two improper uses of the name have appeared in print. In Brand's treatment of *Cryptantha*, in the Pflanzenreich, Heft. 97, p. 63. 1931, the name *Cryptantha mexicana* Brandg. appears in the synonymy of *Cryptantha albida*. Brand makes no mention of the binomial, *Krynitzkia mexicana*! It seems clear that the name, *Cryptantha mexicana* was made unintentionally and is to be dismissed as a slip of the pen. In any case, appearing in synonymy, it is not validly published (Intern. Code, Art. 37) and is to be ignored. A more

recent use of the binomial occurs in W. B. McDougall & O. E. Sperry's "Plants of the Big Bend National Park", p. 143. 1951. In this popular, non-technical flora the binomial "*Cryptantha mexicana*" appears bare, without any accompanying citation of author, bibliographic reference or name-bringing synonym. The two lines of English description are so general as to be applicable to at least half the species in the genus. Since I used the name, *Cryptantha mexicana*, in identifying for Dr. Sperry some of his plants from the Big Bend, it does seem probable that McDougall & Sperry used the name as I had applied it. This, however, is only surmise. Since there is no indication that the publication of a new combination was intended by McDougall & Sperry, I am dismissing their use of "*Cryptantha mexicana*" as unintentional and mere incidental mention.

Arnold Arboretum of Harvard University
Jamaica Plain, Massachusetts

PSILOTUM IN TEXAS

DONOVAN S. CORRELL

Recently, my wife and I accompanied Mr. Frank X. Tolbert of the *Dallas Morning News* on a trip to southeast Texas in order to visit Mr. Lance Rosier, noted naturalist of the Big Thicket, at his home in Saratoga. We specifically wanted to see and examine some late-flowering plants of several orchids in the genus *Spiranthes*. While we were hiking through the forest Mr. Rosier incidentally mentioned that some acquaintances of his, Messrs. Ronald A. Pursell and William D. Reese, from Lafayette, Louisiana, had stumbled onto the whisk-fern in a swamp on the nearby Ervin Teel estate. Orchids were immediately relegated to the future while we hastened to the whisk-fern swamp.

Making our way through one of the finest forest stands in east Texas, which included the largest magnolia tree in the state, we soon came to a dense cypress swamp that had long ago been cut over. Growing at the base of an ancient decaying cypress stump, at least 4 feet in diameter, was growing a depauperate clump of *Psilotum nudum*. In order not to destroy the colony, I carefully took two sprigs of the plant without disturbing its coralloid rootstock. A limited search failed to reveal any additional plants in the vicinity. Mr. Rosier assured me, however, that he knew of other localities in the Big Thicket.

The finding of this species adds another family of ferns to the flora of the state and brings the number of pteridophytes known to occur in Texas to 110 species.

PSILOTUM NUDUM (L.) Griseb., Abh. Ges. Wiss. Göttingen 7: 278. 1857.
Fig. 35.

Lycopodium nudum L., Sp. Pl. 1100. 1753.

Plants terrestrial, perennial, with an intricate creeping coralloid rootstock and often forming conspicuous clumps, dark green throughout, rigidly erect and dichotomously branched three to five times, broomlike, usually about 25 cm. tall, rarely up to 50 cm. tall; common stalks simple, 3-angled, up to 4 mm. thick; branches lightly winged along the 3 angles, mostly less than 1 mm. thick; leaves remote, obliquely spreading, reduced to minute subulate scales about 1 mm. long; sporophylls more or less 2-lobed, rudimentary; sporangia light brown or yellowish, lustrous, 3-celled, depressed-globose, about 2 mm. in diameter.

FIG. 35. *Psilotum nudum* (L.) Griseb.: 1, mature plant, showing the coralloid rhizome and sporiferous frond, × ⅔; 2, immature frond of Texas plant, × ⅔; 3, sporangium, about × 6. Illustrated by Phoebejane Horning.

TEXAS: Hardin County, about an old cypress stump in dense swamp, on Ervin Teel estate, 2 miles south of Saratoga, November 18, 1960, *Donovan S. Correll, Helen B. Correll, Frank X. Tolbert & Lance Rosier 23516* (LL).

Psilotum nudum belongs to the family Psilotaceae which consists of two genera, *Tmesipteris* of Oceania and Australasia, with a solitary variable species, and *Psilotum* which includes about 3 species that are widely distributed in warm temperate to tropical regions. The Greek name, *nudum*, means "naked," alluding to the uninvested sporangia.

This species is found in low moist woods and swamps on rotten logs, about the base of trees and stumps, and in humus, more or less partly saprophytic, from Florida to South Carolina, Louisiana and east Texas, through Mexico and Central America to central South America, throughout the West Indies; widely distributed in the Old World tropics.

ADDITIONAL MYRTACEAE FROM MEXICO

Cyrus Longworth Lundell

Calyptranthes Hintonii Lundell, sp. nov.

Arbor parva, 10 m. alta, ramulis gracilibus; folia glabra, chartacea, elliptica vel lanceolato-elliptica, 6.5–8.5 cm. longa, 3.3–4.5 cm. lata, basi acuta, apice obtusa vel acuminata, acumine obtuso, petiolo 4–6 mm. longo; inflorescentia pauciflora, cymoso-paniculata, usque ad 15 cm. longa, pedunculo gracili 3–8 cm. longo; flores sessiles; alabastra obovoidea, glabra, 4–5 mm. longa, stipitata, apiculata; stamina usque ad 6 mm. longa.

A tree, apical buds pubescent with reddish appressed hairs, glabrous otherwise, twigs compressed. Leaves glabrous, chartaceous, elliptic or lanceolate-elliptic, 6.5 to 8.5 cm. long, 3.3 to 4.5 cm. wide, base acute, apex obtuse or obtusely acuminate, the primary veins evident but inconspicuous on both surfaces; petioles glabrous, canaliculate, 4 to 6 mm. long. Inflorescence cymose-paniculate, up to 15 cm. long, often twice as long as the leaves, few-flowered, glabrous, the peduncles compressed, 3 to 8 cm. long. Flowers sessile, apically glomerate, the buds glabrous, 4 to 5 mm. long including the short stipe, apiculate, opening with a shallow cup-like lid, with the petals adhering to the lid. Stamens up to 6 mm. long. Style up to 9 mm. long. Fruits unknown.

MEXICO: Mexico, Temascaltepec, Mina de Auga, in barranca, July 8, 1935, *Geo. B. Hinton 7952* (type, LL), tree, 10 m., fruit edible.

The elongated inflorescences and the glomerate sessile flowers are distinctive. Its affinity appears to be with *C. Zuzygium* (L.) Sw., a species with pedicellate apetalous flowers.

Calyptranthes mexicana Lundell, sp. nov.

Frutex vel arbor parva; folia novella rufo-puberula, chartacea, oblongo-elliptica, lanceolato-elliptica vel lanceolata, 4–6.5 cm. longa, 1.3–3 cm. lata, basi acuta, apice obtusa vel acuminata, acumine obtuso, petiolo 3–6 mm. longo; inflorescentia minute rufo-puberula, cymoso-paniculata, 2.5–10 cm. longa, pedunculo 1.5–4.5 cm. longo; flores sessiles; alabastra minute puberula, obovoidea, 2.5–3 mm. longa, stipitata. Bacca globosa, 6–12 mm. diam.; cotyledonibus foliaceis contorto-plicatis.

Shrub or tree, 7 to 8 m. high, buds and young leaves appressed puberulent with reddish hairs, glabrate early, twigs slender. Leaves chartaceous, oblong-elliptic, lanceolate-elliptic, or lanceolate, 4 to 6.5 cm. long, 1.3 to 3 cm. wide, base acute, apex obtuse or obtusely acuminate, paler on under-

surface, the veins inconspicuous, the midvein impressed above. Petioles drying black, canaliculate, 3 to 6 mm. long. Inflorescence minutely appressed puberulent with reddish hairs at first, glabrate early, cymose-paniculate, 2.5 to 10 cm. long, usually exceeding the leaves, the peduncles 1.5 to 4.5 cm. long. Flowers glomerate, sessile, the flower buds minutely puberulent with appressed reddish hairs at first, essentially glabrous except for the stipe at anthesis, obovoid, 2.5 to 3 mm. long, inconspicuously apiculate, opening with a shallow cup-like lid to which the petals adhere at anthesis. Fruits glabrous, globose or depressed-globose, 6 to 12 mm. in diameter, 1- to 4-seeded. Cotyledons foliaceous, contort-plicate, the radicle elongate.

MEXICO: Chiapas, Mt. Ovando, near Escuintla, April 9, 1937, *Eizi Matuda 1838* (type, LL), shrub; same locality, April 5, 1936, *Matuda S-43* (LL), *866* (LL), shrub. Tres Cruces, Sierra Madre, alt. 2600 m., February 26, 1945, *Matuda 5024* (LL), a tree 7–8 m. high.

All of the collections except *Matuda 5024* were distributed as *C. Schiedeana* Berg, and I have reluctantly concluded that a distinct species is represented. Both Berg (Linnaea 27: 28. 1855) and Amshoff (Ann. Missouri Bot. Gard. 45: 167–169. 1958) describe *C. Schiedeana* as glabrous, whereas in *C. mexicana* the young growth and inflorescences are appressed puberulent with reddish hairs. Flowers of the latter are sessile.

Eugenia pueblana Lundell, sp. nov.

Arbor parva, ramulis puberulis; folia petiolata, petiolo 3–5 mm. longo; lamina chartacea, lanceolato-elliptica vel lanceolata, 2.5–5 cm. longa, 1–2.4 cm. lata, apice obtuse acuminata, basi acuta; flores fasciculati; pedicelli fructiferi ca. 1 mm. longi; fructus subglobosus, 1–1.8 cm. longus, 1.3–2 cm. diam.

Slender arborescent shrub, about 2.5 m. high; twigs slender, subterete, compressed at the nodes, minutely puberulent. Leaves glabrous at maturity except for petioles and costa on upper surface; petioles slender, puberulent at first, 3 to 5 mm. long; the blades chartaceous, paler beneath, lanceolate-elliptic or lanceolate, 2.5 to 5 cm. long, 1 to 2.4 cm. wide, apex obtusely acuminate, base acute, costa elevated beneath, slightly impressed above, lateral veins 5 or 6, inconspicuous. Flowers glomerate on old wood, subsessile, the pedicels of buds about 1 mm. long, the pedicels and calyx puberulent, the lobes rounded. Fruiting pedicels not accrescent, about 1 mm. long. Fruits reddish when ripe, 1- to 4-seeded, subglobose or depressed-globose, 1 to 1.8 cm. long, 1.3 to 2 cm. wide. Cotyledons essentially homogeneous, the split very shallow.

MEXICO: Puebla, mountains west of Huauchinango, in wet mixed hardwood-pine-*Podocarpus* forest, Nov. 1, 1943, *C. L. Lundell 12618* (type, LL), slender arborescent shrub, 8 ft. high, fruits blushed red.

The relationship of *E. pueblana* appears to be with *E. xalapensis* (H.B.K.) DC. The large subsessile fruits are distinctive.

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NEW SPECIES AND SOME NOMENCLATURAL CHANGES IN SECTION TUBERARIUM OF SOLANUM

DONOVAN S. CORRELL

During the past several years I have tried to coordinate a large mass of herbarium specimens with the numerous specific and infraspecific proposals that have been made for section Tuberarium of the genus *Solanum*. This, at last, has been essentially completed except for the treatment of those specimens which are not referable to any presently known species.

This paper is concerned with those species that are new to science. Since these are to be illustrated in my forthcoming work on this section of *Solanum* they are not delineated here. Also, since the serial arrangement of all the species has not yet congealed, only a tentative designation is given here as to which series each is eventually to be referred. The serial arrangement will be given in its entirety in the finished work. In addition to these new species, some nomenclatural changes are given.

Since the specimens are soon to be returned to their respective herbaria, it was considered necessary to publish this material prior to the publication of the complete treatise. This will avoid any possible publication of herbarium names during the time-lapse in carrying the finished product through the press.

SERIES ACAULIA

Solanum acaule Bitt. var. **aemulans** (Bitt. & Wittm.) Correll, comb. nov.

Solanum aemulans Bitt. & Wittm., Engl. Bot. Jahrb. 50 (Suppl.): 553. 1914.

Variety *aemulans* represents what is probably the southernmost limit of *S. acaule*. Although the habit and flowers are more or less characteristic of *S. acaule*, the development of a distinct articulation of the pedicel and the typically prominently enlarged terminal leaflet set it apart. In appearance some plants resemble the Mexican *S. demissum* Lindl. and, except for pubescence, in leaf-characters some plants approach *S. megistacrolobum* Bitt. For instance, in some leaves the uppermost pair of lateral leaflets are non-auriculate and strongly decurrent on the leaf-rachis and, in some cases, the lower pairs are also non-auriculate and decurrent on the rachis. Another complication is the fact that a recent collection by E. H. Brücher from the type locality of *S. aemulans* was said to have 24 chromosomes, whereas *S. acaule* is known to have 48 and the species of the series Megistacroloba 24.

Unfortunately, the collection upon which the above chromosome count is based apparently consists of more than one entity. I have seen a collection

by Brücher, without number, from Sierra de Famatina, Prov. La Rioja, Argentina, that is labeled *S. aemulans*. Brücher states on the label that the plants, which would normally have 48 chromosomes, had only 24. A duplicate of this collection provided me by Dr. Brücher consists not only of plants of *S. acaule* var. *aemulans*, but also of plants of what I consider to be *S. Venturii*, a species which Hawkes and Hjerting thought might have 24 chromosomes. It may be that the above chromosome count was based on plants of this latter species.

SERIES APPENDICULATA

Solanum basendopogon Bitt. f. **obtusum** Correll, forma nov.

Planta similis typico *S. basendopogon* sed in ovato-ellipticis late obtusis foliis et valdius pubescentibus differt.

The more common f. *obtusum* differs from typical *S. basendopogon* in having its leaves or primary leaflets ovate-elliptic and broadly obtuse instead of elliptic-lanceolate and shortly acuminate. In some plants a pair of lateral leaflets is sometimes developed on the leaves. Forma *obtusum* is also a stouter and more heavily pubescent plant. The paniculate inflorescence and floral characteristics, however, appear to be essentially similar in both.

PERU: Cuesta of Purruchuca, April 1832, *A. Mathews 526* (E. type; G, GH, GL, OXF, isotypes).

Solanum caripense H. & B. ex Dun. var. **stellatum** Correll, var. nov.

Corolla alte stellata hanc plantam a typico *S. caripense* distinguit.

Vegetatively, this plant is indistinguishable from what we consider to be "typical" *S. caripense*. The stellate corolla, however, readily sets it apart from the essentially rotate corolla of typical *S. caripense*.

COLOMBIA: Cundinamarca Dept., Bogota, in cool woods, April 1844, *J. Goudot s. n.* (K, type; FI, P, isotypes).

Solanum Sodiroi Bitt. var. **dimorphophyllum** (Bitt.) Correll, comb. nov.

Solanum Sodiroi subsp. *dimorphophyllum* Bitt., Repert. Sp. Nov. 11: 247. 1912.

Although simple leaves and others with 3 to 5 leaflets are occasionally to be found in var. *dimorphophyllum*, there are rather consistently a preponderance of leaves with 7 leaflets. Except for this difference in number of leaflets, I can find no other characteristic for maintaining this variety.

Solanum tabanoense Correll, sp. nov.

Planta vitinea, patens, appresso-pubescens; caulis lignosus; folia subcoriacea, integra vel raro cum unis vel duabus laminis inter foliola lateralibus obsoletis; lamina ovato-lanceolata vel lanceolata et acuta vel acuminata; petiolus basi articulatus; inflorescentia pauciflora; pedicelli basi articulati;

calycis lobi ovato-subquadrati, apiculati; corolla stellata; filamenta coronam formare conjugata; stylus gracilis, cellulo-papillosus; fructus longo-ovales vel late ellipsoidales.

Plant with straggly trailing habit, up to 6 dm. or more tall (or long), often wide-spreading, rather densely pilose throughout with the hairs more or less appressed and (except on leaves and calyx) directed downward on the various organs; stem woody, slender and strong, much-branched, rooting at the nodes where these touch the ground; leaves simple or sometimes with one or a pair of poorly developed lateral leaflets, thick-membranaceous to subcoriaceous, ovate-lanceolate to elliptic-lanceolate or lanceolate, broadly rounded at the base, acute to shortly acuminate at apex, up to 6.5 cm. long and 2.5 cm. wide; petiole rarely more than 1.5 cm. long, articulate at base; pseudostipular leaves lunate, up to about 1 cm. long; inflorescence pseudoterminal and/or lateral, a 6- to 12-flowered raceme; peduncle rather rigid, 3.5–10 cm. long (including the short raceme); pedicels 1–1.5 cm. long, articulate at base; flowers pale dull purple; calyx about 5 mm. long, divided to about the middle into ovate subquadrate long-apiculate lobes; corolla stellate, divided to well below the middle or to near the base into narrowly elliptic obtuse lobes that are 1–2 cm. long and densely pilose on the outer surface, the apex of lobes fleshy-thickened and irregularly cucullate; anthers lanceolate to linear in outline, 5–6 mm. long; filaments united to near their apex to form a crown, with the crown fimbriate on its margin; style slender, 6–7 mm. long, cellular-papillose below the middle; fruit long-oval or broadly ellipsoid, turning dark purple or blackish when ripe, up to 5.5 cm. long.

The large fruits and essentially entire leaves set this plant apart from *S. caripense* var. *stellatum*. The plant also lacks the bushy habit of *S. caripense*. It is a lax, straggly, trailing plant.

COLOMBIA: Dept. Putumayo, Páramo el Tábano, "Beniadores," May 14, 1935, *H. Garcia B. 4551* (US, type).

SERIES CIRCAEIFOLIA

Solanum circaeifolium Bitt. f. **lobatum** Correll, forma nov.

Planta typo *S. circaeifolium* similis, sed vadius dilatalis foliis lateralibus et pubescentia supra densiore foliorum lateralium differt.

Forma *lobatum* has more fully developed lateral leaflets, often as many as four, and is more pubescent with coarse hairs, especially on the upper surface of the leaflets. It reveals a possible mixing with *S. capsicibaccatum* Cárd.

BOLIVIA: Dept. Cochabamba, Lagunillas, over the mountain range behind Choro in the St. Elena Valley, under bushes on thicket slopes, 2,900 m. alt., March 7, 1950, *Miss W. M. A. Brooke 6158* (BM, type).

SERIES COMMERSONIANA

Solanum chacoense Bitt. f. **caipipendense** (Cárd.) Correll, comb. nov.

Solanum caipipendense Cárd., Bol. Soc. Peruana Bot. 5: 35, *pls. III* (*D*, *figs. 1–4*) and *V*(*B*). 1956.

This is merely a tall, robust form of typical *S. chacoense*. It has broad, long-petiolulate leaflets, usually numerous flowers, and light brown tubers that are 2–4 cm. in diameter.

Solanum chacoense f. **gibberulosum** (Juz. & Buk.) Correll, comb. nov.

Solanum gibberulosum Juz. & Buk., Rev. Arg. Agron. 3: 225. 1936; Bull. Acad. Sci. U. R. S. S., ser. Biol. 2: 318. 1937.

This form comprises most of those plants from the vicinity of Córdoba, Argentina, that have leaflets which are subcoriaceous, shiny-vernicose on the upper surface, and noticeably hispid on the margins and on the veins of the lower surface. Bristly, somewhat gibbose, hairs are especially conspicuous on the lower surface of the leaflets and in the inflorescence. Capitate glands are also found on most of the collections.

In some respect, the plants vegetatively resemble several species in the series Piurana. Doubtlessly, the dry, hot climatic conditions under which they grow have influenced their development.

Solanum chacoense f. **pilosulum** Hassl.

Solanum Commersonii β pubescens Chodat, Plantae Hasslerianae (Bul. Herb. Boiss., ser. 2, 2: 812). 1902. Type: Paraguay, In campis pr. San Bernardino, flor. mens. Dec., *E. Hassler 3674*.

S. guaraniticum Hassl. var. *latisectum* Hassl., Repert. Sp. Nov. 9: 115. 1911.

S. guaraniticum var. *latisectum* f. *pilosula* Hassl., Repert. Sp. Nov. 9: 116. 1911. Type: Paraguay, in campis pr. San Bernardino, flor. mens. Dec., *E. Hassler 3674*.

S. chacoense var. *latisectum* f. *pilosulum* Hassl., Ann. Conserv. & Jard. Bot. Geneve 20: 186. *fig. 4c*. 1917.

Plants of typical *S. chacoense*, based on the Hassler collection No. 2805, are essentially glabrous throughout. A rather large number of collections have been made, however, that are more or less pubescent -sometimes densely so. Besides being pubescent, most of the specimens have the apicule on their calyx lobes more fully developed (sometimes prominently so) and the leaflets are frequently somewhat narrower and less petiolulate than in typical material. Some of the plants possess the laxly branched inflorescence of typical *S. chacoense* while others, as represented by Hassler's collection No. 11849, have the characteristically compact inflorescence of *S. Commersonii* Dun. Some plants are provided with scattered glandular hairs, especially in the inflorescence, while others do not possess this characteristic. These rather heterogeneous pubescent plants, which perhaps represent a mixing of *S. chacoense* with *S. Commersonii* (as we interpret these species) *S. Kurtzianum* Bitt. & Wittm. and possibly other species, are for the time being relegated to the appropriate epithet, *pilosulum*.

A complete synonymy is not included here but it will be given in my published treatise.

Solanum Commersonii f. **Malmeanum** (Bitt.) Correll, comb. nov.

Solanum Malmeanum Bitt., Repert. Sp. Nov. 12: 447. 1913.
S. Millanii Buk. & Lechn., Rev. Argentina Agron. 2: 180. 1935.

Forma *Malmeanum* differs from typical *S. Commersonii* in that at least some of the four or five pairs of lateral leaflets are distinctly petiolulate and there are often two or more interstitial leaflets between each pair of lateral leaflets. Similarly to typical *S. Commersonii*, the plants are more or less pubescent and have a compact inflorescence. This form is distinguished from *S. chacoense* f. *pilosulum*, which it closely resembles, by its typically triangular-lanceolate calyx lobes. As in the case of other subspecific segregates in this series, this form might represent a hybridization of *S. Commersonii* and *S. chacoense*.

Solanum Commersonii f. **mechonguense** (Buk.) Correll, comb. nov.

Solanum Commersonii var. *violaceum* Herter, Estud. Bot. Reg. Uruguaya (Fl. Uruguayensis, Pl. Vasc.) 4: 110. 1930, *nomen*.
S. mechonguense Buk., Rev. Argentina Agron. 7: 363. 1940; Sov. Pl. Ind. Rec. 4: 12. 1940.

This plant differs from typical *S. Commersonii* in having its corolla more narrowly and deeply lobed, often to near the base. The flowers are also commonly more intensely colored with purplish violet.

Solanum Muelleri Bitt. f. **densipilosum** Correll, forma nov.

Herba habitu typo S. Muelleri similis est. Folia et caules non glabra sunt sed cum longis, albis pilis prominenter articulatis dense investiuntur.

In habit this plant is identical to typical *S. Muelleri*, as it occurs in nature. Instead of being essentially glabrous, however, its leaves and stems are densely invested by long, whitish, prominently jointed hairs.

Brazil: Santa Catarina, Mun. Chapecó, Campo, bog, Fazenda Campo São Vicente, 24 km. west of Campo Eré, 900–1000 m. alt., December 26–28, 1956, *L. B. Smith, Pe. R. Reitz & L. Caldato 9516* (US, type).

Solanum tarijense Hawkes var. **pojoense** (Cárd.) Correll, comb. nov.

Solanum vallegrandense Cárd., Bol. Soc. Peruana Bot. 5: 23, *pl. II (B), figs. 1–2.* 1956.
S. vallegrandense var. *pojoense* Cárd., Bol. Soc. Peruana Bot. 5: 24, *pl. II (C), figs. 1–3.* 1956.

The smaller corolla and calyx are the only obvious differences that separate var. *pojoense* from typical *S. tarijense*. Although Cárdenas states that the corollas of *S. vallegrandense* and its var. *pojoense* are rotate, his

drawings of the corollas and those of the flowers of the type specimens are distinctly stellate. The leaves of the type of var. *pojoense* have fewer interstitial leaflets than in typical material.

SERIES CONICIBACCATA

Solanum claviformum Correll, sp. nov.

Planta gracilis, omnino glabra; tubera ignota; caulis gracilis, teres; folia imparipinnata, laxa, sine vel cum compluribus laminis inter foliola; foliola sessilia vel petiolulata, lanceolata, acuminata; inflorescentia pauciflora; pedicelli infra medium vel prope basim articulati, saepe minute verrucosi, gradatim supra articulum dilatati; calycis lobi ovato-subquadrati, apiculati; corolla rotato-stellata; filamenta glabra, basi conjugata; stylus cellulo-papillosus.

Plant slender, lax, up to 1 m. tall, completely glabrous throughout; tubers (if present) unknown; stem slender, stramineous, terete; leaves odd-pinnate, lax, up to 17 cm. long, without or sometimes with one or several interstitial leaflets; leaflets 9 or 11; lateral leaflets essentially sessile to slender-petiolulate, lanceolate, rounded at the oblique base, acuminate at apex, up to 5 cm. long and 1.5 cm. wide; terminal leaflet similar to the lateral ones; pseudostipular leaves semielliptic, falcate, less than 1 cm. long; inflorescences pseudoterminal and/or lateral, cymosely paniculate, about 12-flowered; peduncle slender, stramineous, up to 11 cm. long; pedicels 1.5–2 cm. long, conspicuously articulate well below the middle to near the base or very rarely to just below the middle, gradually dilated above the articulation to form a slender club that is sometimes minutely warty; flowers purple; calyx about 4 mm. long, divided to about the middle into ovate-subquadrate apiculate lobes; corolla rotate-stellate, 2–2.5 cm. in diameter; anthers about 5 mm. long, linear-oblong in outline, with a basal dorsal central lobule; filaments 1 mm. long, glabrous, united at base; style 6–7 mm. long, cellular-papillose below the middle; fruit unknown but the ovary is ovoid.

PERU: Dept. Huánuco, Carpish, Km. 60 between Huánuco and Tingo María, plant to 1 m. high, corolla purple, May 28, 1946, *Charles Swingle 66* (US, type).

This is a lax plant with conspicuously wide-spreading, mostly lateral, inflorescences and low pedicel-articulations. The portion of the pedicel above the articulation is noticeably dilated into the calyx to form a slender, often warty, club.

Solanum filamentum Correll, sp. nov.

Planta laxa, omnino subglabra; tubera ignota; caulis gracilis, teres, stramineus; folia imparipinnata, laxa, elongata, sine laminis inter foliola; foliola plusminusve petiolulata, elliptico-lanceolata, acuta vel acuminata; inflorescentia laxe pauciflora; pedicelli filamentosi, in medio vel super medium articulati; calycis lobi ovati, apicibus crassis; corolla parva,

rotata; filamenta glabra; stylus crassus, subtus cellulo-papillosus; fructus immaturi conici.

Plant weakly erect or ascending (only upper part seen), up to at least 5 dm. tall, doubtless much taller, essentially glabrous throughout or only sparsely pubescent; tubers (if any) unknown; stem slender, terete, stramineous; leaves odd-pinnate, lax and mostly elongated, up to 32 cm. long, without interstitial leaflets; leaflets 7 to 13, sessile or usually prominently petiolulate, elliptic-lanceolate, acute to shortly acuminate at apex, rounded at the usually oblique base, up to 7.5 cm. long and 2 cm. wide; pseudostipular leaves semielliptic, falcate, up to about 1.5 cm. long; inflorescences pseudoterminal on branches, a few-flowered cymose panicle; peduncle very slender, up to 8 cm. long, branched above; pedicels filamentous (thread-like), up to 3 cm. long, articulate at about or above the middle; flowers purplish, small; calyx 3–3.5 mm. long, divided to below the middle into ovate abruptly long-apiculate (and fleshy) lobes, with the edges brownish marginate; corolla rotate, about 1.2 cm. in diameter; anthers oblong in outline, 2–3 mm. long, the pores large and conspicuous; filaments up to 1 mm. long, glabrous; style about 4 mm. long, stout, cellular-papillose below the middle; fruit (immature) conical.

VENEZUELA: Páramo de Piñango, 2,600 m. alt., March 17, 1915, *Alfredo Jahn 406* (US, type).

The long, lax leaves without interstitial leaflets and the small flowers that are supported by long, filamentous pedicels are characteristics of this species. Also, the conspicuously large pores of the small anthers with their brownish marginate orifice and the stout, cellular-papillose style are additional distinctions.

Solanum filamentum appears to be most closely allied to *S. colombianum* Dun. and *S. oxycarpum* Schiede, but the above-noted characteristics set it apart from those species.

Solanum laxissimum Bitt. f. **Rockefelleri** (Vargas) Correll, comb. nov.

Solanum Rockefelleriae Vargas, Las Papas Sudperuanas, Part II (Publ. Univ. Nac. Cuzco): 54, *fig. 7*. 1956.

The longer pedicel, with its high articulation, and the smaller corolla distinguish this plant from typical *S. laxissimum*. From *S. santolallae* Vargas it is distinguished by the differently shaped corolla and the high articulation of the pedicels.

Solanum reconditum Correll, nom. nov.

Solanum confusum Corr., Sect. Tuberarium of Genus Solanum of N. Amer. and Centr. Amer. (Agr. Monogr. No. 11, U. S. Dept. Agr.) 63, *figs. 41–42*. 1952 (not Morton, 1944).

S. Nelsonii Corr., Madroño 14: 236. 1958 (not Dunal, 1852).

Because of a *lapsus memoriae* on my part this plant has to be encumbered with another synonym.

Solanum santolallae Vargas f. **velutinum** Correll, forma nov.

Characteribus vegetabilibus *S. santolallae* simile, tecto velutino omnino a specie differt.

In habit and general characteristics this plant is similar to typical *S. santolallae*. However, instead of being essentially glabrous or at most sparsely pubescent, f. *velutinum*, as the name implies, has a dense covering of velvety hairs.

PERU: Cuzco Department, along stream near Machu-Picchu railway station, flowers purplish, only one plant found, March 3, 1958, *D. S. Correll & E. E. Smith P261* (LL, type).

SERIES CUNEOALATA

Solanum Brucheri Correll, sp. nov.

Planta subrosulata vel debiliter adscendens et patula, omnino plusminusve crasse pubescens, acaulis vel cum caule brevi; tubera ignota; folia imparipinnata, vulgo sine laminis inter foliola; foliola septem usque ad tredecim, sessilia et in folii rache plusminusve decurrentia, elliptica, obtusa; inflorescentia pauciflora; pedunculus abbreviatus vel absens; pedicelli elongati, bene supra medium articulati; lobi calycis ovati vel ovato-lanceolati, acuminati; corolla rotato-stellata vel subrotata; filamenta glabra; stylus crassus, glaber; stigma capitatum; fructus ignoti.

Plant subrosette to weakly ascending and spreading, rarely up to 3 dm. tall, stoloniferous but no tubers seen, sparsely or sometimes densely pubescent throughout with coarse short hairs; tubers unknown; stem much abbreviated to somewhat elongate, slender, branched; leaves odd-pinnate, up to 18 cm. long, without or sometimes with a few small interstitial leaflets; leaflets 7 to 13; lateral leaflets sessile and usually decurrent (especially the uppermost pair) on the leaf-rachis, elliptic, obtuse to rarely subacute at apex, rounded at the oblique base, up to 5 cm. long and 2 cm. wide, usually much smaller, progressively smaller from the uppermost pair to the lowermost pair; terminal leaflet slightly larger than the lateral ones; pseudostipular leaves semielliptic, falcate, up to about 1 cm. long; inflorescences several-flowered, pseudoterminal on the main stem or branches and sometimes lateral on the stem; peduncle essentially lacking to rarely up to 3.5 cm. long; pedicels stout, elongated, up to about 3 cm. long, inconspicuously or noticeably articulate within 1 cm. of the calyx; flowers purplish; calyx 4.5–6.5 mm. long, usually densely pubescent, divided to about or below the middle into ovate to ovate-lanceolate acuminate lobes that are slightly constricted above the middle; corolla rotate-stellate to subrotate, about 2 cm. in diameter; anthers 3–4 mm. long, linear-oblong in outline; filaments 1–1.5 mm. long, glabrous; style stout, glabrous, up to 8 mm. long, the stigma capitate; fruit unknown.

ARGENTINA: Prov. Jujuy, with other tuberous Solanums in moist places about spring at corral, Puesto I, Tilcara, 3,650 m. alt., March 1955, *H. & O. Brücher 557* (LL, type); Prov. Jujuy, about a rock wall, flowers purple, Rancho Iturbe, about 3,600 m. alt., February 25, 1960, *D. S. Correll, K. S. Dodds, E. H. Brücher & G. J. Paxman A667* (LL, paratype).

This species shows some affinity with several species, but mainly with *S. acaule*, *S. sanctae-rosae* Hawkes and *S. infundibuliforme* Bitt. Its plainly articulate pedicels, obtusish leaflets, and broader leaflets, respectively, separate it from those species.

It is of interest that this species is frequently abundant where domesticated animals congregate, especially in the vicinity of stone wall inclosures and corrals.

Dr. Enrique H. Brücher, of Mendoza, Argentina, pointed out the apparent uniqueness of this plant to me while we were on a memorable collecting trip in northwest Argentina in 1960. It is a pleasure to name this species for him.

SERIES JUGLANDIFOLIA

Solanum Rickii Correll, sp. nov.

Planta herbacea, erecta, basi lignosa, non tuberifera, sparsim omnino glanduloso-pubescens; folia imparipinnata, coriacea, brevia, sine vel cum compluribus laminis inter foliola; foliola septem vel novem irregulatim lobulata vel crasse crenata; inflorescentia multiflora; pedicelli crassi, paululum infra calycem prominenter articulati; calycis lobi suculento-incrassati, ovati, acuti; corolla stellata; filamenta gracilia, glabra; stylus crassus, prope apice prominenter recurvus, ad medium et infra medium valde pilosus; fructus globosi.

Plant herbaceous, perennial, with a woody rootstock, erect, 2–5 dm. tall, non-tuber-bearing, bright green, sparsely glandular-capitate and with scattered short hairs throughout, outwardly appearing to be glabrous; stem stout, terete, branched or rarely simple; leaves odd-pinnate, without or sometimes with interstitial leaflets, short and fleshy-coriaceous, up to about 4 cm. long, shortly petiolate with the petiole basally articulate; leaflets mostly 7 or 9, irregularly lobulate or coarsely crenate; lateral leaflets subopposite to alternate, up to about 2 cm. long; terminal leaflet similar to the lateral ones; pseudostipular leaves obliquely elliptic, commonly lobulate, up to about 1 cm. long; inflorescences pseudoterminal on the branches or sometimes lateral, a compact many-flowered cymose paniele, commonly bracteate; peduncle short, stout, up to about 4 cm. long, several-branched above; pedicels stout, about 1 cm. long at anthesis, prominently articulate about 1 mm. below the calyx; flowers bright yellow; calyx fleshy-thickened, about 5 mm. long, divided to about or below the middle into ovate acute lobes that are slightly constricted above; corolla broadly stellate, 2–2.5 cm. in diameter, the lobes broadly triangular-ovate; anthers linear-oblong in

outline, 6–8 mm. long; filaments slender, about 1 mm. long, glabrous; style stout, strongly recurved near the apex, densely pilose on the lower two thirds, about 1 cm. long, the stigma slightly thickened; fruit globose, moist (when immature), the pericarp thin and fleshy but becoming dry and papery shortly after ripening, about 1 cm. in diameter.

CHILE: Prov. Antofagasta, in shallow ravines of hills ½ km. north of village of Chuquicamata at approximately 3,000 m. alt., erect herb, 20–50 cm. tall, fruits green, moist in immature stages, ripening to dry papery consistency; associating with *Calandrinia* sp., scattered population of 14 plants, January 8, 1957, *C. M. Rick SAL-224* (LL, type; AHUC, isotype).

This is a distinctive species that is most closely related to *S. lycopersicoides* Dun. There are, however, a number of morphological differences between them. The present species is a low, essentially glabrous, fleshy-leaved herb as compared to the somewhat shrubby, heavily pubescent, thin-leaved *S. lycopersicoides*. Its corolla is also stellate instead of being rotate-pentagonal. One of the most critical differences is in their fruits. The fruits of *S. Rickii* have a thin pericarp and become dry and papery shortly after ripening whereas the fruits of *S. lycopersicoides* have a tough, thick pericarp and usually remain moist in the interior for long periods after reaching maturity.

It is a pleasure to name this species for its collector, Dr. Charles M. Rick, who has long been engaged in genetic investigations in the improvement of the tomato (*Lycopersicon esculentum* Mill.) through breeding it with indigenous species. I am indebted to Dr. Rick for providing me with notes from his field observations of this species and of *S. lycopersicoides*.

SERIES MURICATA

Solanum muricatum Ait. f. **glaberrimum** Correll, forma nov.

Planta similis typico *S. muricatum* sed omnino glabera est.

This plant is entirely glabrous throughout in contrast to the appressed-strigose condition of all other plants that make up this species.

PERU: Dept. Lima, Hacienda Paramonga, Río Pativilca Valley, said to be 5 types based on size of fruit and color, edible, herb. 7.5 dm. tall, flowers purple, fruit pale green, purple stripes, 3 inches long, 2½ inches in diameter, "pepino," "pepino blanco," September 23, 1945, *R. J. Seibert 2176* (US, type).

SERIES PIURANA

Solanum Albornozii Correll, sp. nov.

Planta fruticosa et erecta, stolonifera et tuberifera; tubera ellipsoidea; caulis crassus, simplex vel ramosus, anguste alatus; folia imparipinnata cum crebis laminis inter foliola; foliola novem usque ad undecim, distincte petiolulata, lanceolata vel anguste elliptico-lanceolata, acuminata, supra

subglabra, subtus puberula; inflorescentia multiflora; pedicelli graciles, glabri, circiter in medio prominente articulati; flores albi cum violacea linea subter quodque petalum; calycis lobi rotundati, apiculati; corolla stellata vel rotato-substellata; filamenta glabra; stylus glabrus; fructus ovoidei.

Plant bushy and erect, up to 5 dm. tall, long-stoloniferous and tuber-bearing; tubers ellipsoid, up to 5 cm. long; stem rather stout, simple or branched near the base, narrowly winged, glabrous; leaves odd-pinnate, up to 18 cm. long, with numerous several-sized interstitial leaflets arising from the edges of the longitudinal grooves of the somewhat puberulent leaf-rachis; leaflets 9 or 11, rarely fewer, distinctly petiolulate, dark green and essentially glabrous to very sparsely pubescent on the upper surface, lighter green and puberulent on the lower surface, with the margins slightly revolute and becoming crinkly with drying; lateral leaflets lanceolate to narrowly elliptic-lanceolate, tapering to an acute to acuminate apex, rounded at the more or less oblique base, up to 6 cm. long and 1.5 cm. wide; terminal leaflet sometimes slightly larger than the lateral ones; pseudo-stipular leaves semielliptic, strongly arcuate, up to about 1 cm. long; inflorescence a many-flowered cymose panicle; peduncle slender, glabrous, up to 10 cm. long, widely branched above; pedicels slender, glabrous, 1.5–2.3 cm. long, prominently articulate at about the middle; flowers white with a lavender stripe on the back of each petal; calyx 3–4 mm. long, glabrous, shallowly divided to above the middle into rounded apiculate lobes; corolla stellate to rotate-stellate or occasionally rotate-substellate, 2.5–3 cm. in diameter; anthers lanceolate in outline, 6–7 mm. long; filaments about 1 mm. long, glabrous; style about 1 cm. long, glabrous; fruit (immature) ovoid, 1 cm. or more long.

ECUADOR: Prov. Loja, among bushes in clearings on upper slopes of Villonaco, 15 km. from Loja on road to Catamayo, plants bushy, leaves dark green above, light green beneath, flowers white with lavender stripes on back, stellate to rotate-stellate, tubers large, up to 5 cm. long, March 17, 1958, *D. S. Correll & G. Albornoz P.E381* (LL, type; US, isotype).

In habit, this plant is essentially identical to most of those segregated as *S. chomatophilum* f. *angustifoliolum*. Because of this outward similarity, it would seem that these entities should perhaps be considered as representing two phases of the same species. There are, however, distinct differences that set them apart.

Solanum Albornozii has a white, lavender-striped basically rotate-stellate corolla, a small calyx with short symmetrical lobes, and a densely puberulent lower surface to the leaflets. Also, the inflorescence is more open with the branches longer and more spreading, and the pedicels are usually articulate at about the middle.

This plant is named for Dr. Albornoz, of the University of Quito, who was my congenial companion during our exploration of the potato regions of Ecuador.

Solanum chomatophilum Bitt. f. **angustifoliolum** Correll, forma nov.

Planta similis typico *S. chomatophilum* sed foliola angustioria sunt et foliola lanceolata vel anguste elliptico-lanceolata et subacuta vel acuminata sunt; plures laminae inter foliola et lobi saepe bilabiati calycis longiores sunt.

Forma *angustifoliolum*, as its name implies, differs from typical *S. chomatophilum* in having narrower leaflets, these being lanceolate to narrowly elliptic-lanceolate and subacute to acuminate at the apex. It also usually has more numerous interstitial leaflets and the calyx, which is sometimes so irregular as to be bilabiate, has typically longer lobes.

ECUADOR: Azuay Prov., in wet thicket area in small valley, 56 km. from Cuenca on road to Loja, 3,100 m. alt., flowers lavender, March 16, 1958, *D. S. Correll & G. Albornoz P.E374* (LL, type; US, isotype).

Solanum chomatophilum Bitt. f. **pilosum** Correll, forma nov.

Forma *pilosum* plantis minoribus et caulibus foliisque dense pilosis a typico *S. chomatophilum* differt.

Except for being more dwarf than usual, f. *pilosum* differs from typical *S. chomatophilum* only in having its stems and leaves rather densely pilose.

PERU: Dept. Piura, climbing from Canchaque to the pass "Cuello del Indio" on the road from Canchaque to Huancabamba, June 19, 1952, *C. Ochoa 1795* (US, type).

Solanum cyanophyllum Correll, sp. nov.

Planta alta, robusta, stolonifera; tubera ignota; caulis gracilis, integer, non alatus; folia imparipinnata, cum laminis inter foliola, rachi leviter alata; foliola novem, petiolata, elliptico-lanceolata, acuminato-attenuata, supra vernicosa, pallide viridia, parce pubescentia cum pilis crassis, subtus cyanea, pilosa; inflorescentia multiflora; pedunculus gracilis, puberulus; pedicelli puberuli, supra medium articulati; calyx leviter puberulus, trilabiatus cum aliquibus lobis partim conjunctis; corolla rotata, spectabilis; filamenta lata, glabra; stylus gracilis, glaber; fructus ignoti.

Plant tall and robust, 12.5 dm. tall, stoloniferous and probably tuber-bearing; tubers unknown; stem unbranched, wingless, terete, slender, stramineous below, brownish above, essentially glabrous or lightly puberulent; leaves odd-pinnate, up to 22 cm. long, with scattered several-sized interstitial leaflets, the rachis very lightly winged; leaflets 9, shiny light green and with scattered coarse hairs on the upper surface, dark blue and finely pubescent on the lower surface; lateral leaflets petiolulate with the petiolule often lightly winged, elliptic-lanceolate, acuminate and commonly attenuate at the apex, broadly cuneate to rounded at the oblique base, up to 8.5 cm. long and 2.5 cm. wide, the lowermost pair greatly reduced; terminal leaflet slightly wider than the lateral ones; pseudostipular leaves semiovate-lanceolate, oblique, up to 2 cm. long; inflorescence pseudo-

terminal, a many-flowered cymose panicle; peduncle slender, 4 cm. long, puberulent, branched above; pedicels slender, puberulent, about 2 cm. long, articulate above the middle; flowers rather showy, white mottled with lavender; calyx 8–10 mm. long, lightly puberulent, conspicuously and deeply trilabiate to below the middle, with two pairs of lobes partially united to form an attenuately bilobed apex to two of the segments (labia), the three lobes (or labia) ovate-lanceolate; corolla rotate-pentagonal, 2.5–3.5 cm. in diameter; anthers lanceolate in outline, about 7 mm. long; filaments broad, glabrous, about 1.5 mm. long; style slender, glabrous, about 1 cm. long, the stigma only slightly enlarged; fruit unknown.

ECUADOR: Prov. Bolívar, below San Jacinto de la Unión, cleared forest, about 2,300 m. alt., August 15, 1939, *Erik Asplund 8325* (S, type).

The dark blue to almost blackish lower surface of the leaflets and pseudostipular leaves, the peculiarly lobed calyx, and the tall, simple-stemmed plant are distinguishing characteristics of this species.

Solanum immite Dun. var. **vernale** Correll, var. nov.

Haec varietas planta majore et planta vernale florente in "loma" regione non autumna florente in monte a typico *S. immite* differt.

Variety *vernale* is not only a larger plant than most of the material referable to typical *S. immite* but, as its name implies, it also flowers in the spring (August) instead of in the fall as in typical *S. immite*. It also occurs in the loma region instead of at high elevations.

PERU: Dept. Lima, rocky valley, about 8 km. east of San Barkolo, about 125 m. alt., August 2, 1953, *S. C. E. Saunders 185* (BM, type).

Solanum jalcae Ochoa var. **pubescens** Correll, var. nov.

Planta similis typico *S. jalcae* sed in sparsis pubescentibus et minus late folii rachi et pluribus laminis inter foliola differt.

Variety pubescens has a less broadly winged leaf-rachis than in typical *S. jalcae*, with quite a few interstitial leaflets. Also, instead of being glabrous, the stems, leaf-rachis, margins of the leaflets on the upper surface and lower surface of leaflets are usually sparsely pilose. In fact, with further study, this plant may eventually prove to be a hybrid between *S. jalcae* and the Ecuadorean *S. Solisii* Hawkes.

PERU: Dept. Cajamarca, rocky grassy open slopes, near entrance to Hacienda Porcon, north of Cajamarca, 3,550 m. alt., March 25, 1960, *D. S. Correll & E. E. Smith P866* (LL, type) and *P867* (LL, paratype).

Solanum marinasense Vargas f. **longimucronatum** (Vargas) Correll, comb. nov.

Solanum longimucronatum Vargas, Las Papas Sudperuanas, Part II (Publ. Univ. Nac. Cuzco): 60, *fig. 17* [leaf illustrated is not typical of type material]. 1956.

Forma *longimucronatum* differs from the type of *S. marinasense* in having the somewhat larger leaflets densely pubescent on the upper surface instead of being essentially glabrous and shiny. Also, it has more interstitial leaflets.

The leaf used to illustrate *S. longimucronatum* when it was originally described is lacking interstitial leaflets. The leaves of all the type material I have seen have three or more small orbicular interstitial leaflets.

Solanum moniliforme Correll, sp. nov.

Planta robusta, basi ramosissima, omnino glabra; tubera alba, moniliformia; folia imparipinnata, saepe cum laminis inter foliola; foliola septem, sessilia vel subsessilia, late elliptica vel obovato-elliptica, obtusa; inflorescentia multiflora; pedicelli crassi, paululum infra calycem prominenter articulati; calyx crassus, lobi ovati et apiculati; corolla late rotato-stellata; filamenta concavo-cymbiformia, glabra; stylus glaber.

Plant large, robust, much-branched at base with the branches widely spreading, up to 1 m. or more tall (or long), glabrous throughout; tubers white, irregularly shaped, up to about 2 cm. in diameter, arranged in the form of a necklace on the stolons (moniliform); stem stout, very narrowly winged, up to 1.5 cm. or more thick; leaves odd-pinnate, up to 25 cm. long, without or usually with interstitial leaflets; leaflets 7 or 9, with the lowermost pair of lateral leaflets mostly greatly reduced, sessile or with a short winged petiolule, sometimes slightly decurrent on the leaf-rachis, broadly elliptic to occasionally obovate-elliptic, obtuse at apex, rounded to broadly cuneate at the oblique base, up to 10 cm. long and 5.5 cm. wide, the terminal leaflet only slightly larger than the lateral ones, prominently veiny; pseudostipular leaves semielliptic, lunate, up to about 2 cm. long; inflorescence pseudoterminal on the branches, showy, a many-flowered cymose panicle; peduncle stout, up to 14 cm. long, several-branched above; pedicels stout, 2–4 cm. long, prominently articulate 2–3 mm. below the calyx; flowers large and showy, lavender, with a dark stripe on the back of each petal; calyx fleshy-thickened, pigmented with dark purple, 7–10 mm. long, divided to about or slightly above the middle into triangular-ovate to ovate somewhat apiculate lobes; corolla broadly rotate-stellate, up to 5 cm. in diameter; anthers broadly lanceolate in outline, about 8 mm. long; filaments broad, concave-cymbiform on the inner face, glabrous, 1–2 mm. long above their attachment to the corolla; style 1–1.2 cm. long, glabrous, with the stigma dilated; fruit unknown but the ovary is globose.

PERU: Dept. Ancash, among boulders on west side of mountains at km. 311, a few km. below Conococha on road to coast, 3,900 m. alt., plants robust, much-branched at base (spec. made from part of single branch), flowers lavender with darker stripe on back of petals, broadly rotate-stellate, tubers white, irregular, arranged as a necklace, March 31, 1960, *D. S. Correll & E. E. Smith P974* (LL, type; US, isotype).

This species is most closely allied to *S. chomatophilum* and *S. jalcae*. It differs primarily from the apparently tuberless *S. chomatophilum* in produc-

ing tubers that are uniquely arranged along the stolon to form a necklace. Also, it consistently has its pedicels articulate 2–3 mm. below the calyx, the style is glabrous, and the plants are extremely robust.

Solanum moniliforme is similar to *S. jalcae* in its manner of producing tubers and in its high articulation of the pedicel, but it differs from that species in lacking a broadly winged leaf-rachis, in its glabrous style, more numerous interstitial leaflets and in its more robust nature.

Solanum pampasense Hawkes f. **glabrescens** Correll, forma nov.

Planta similis typico *S. pampasense* sed foliolis glabris supra vernicosis, inflorescentiae minore pubescentiae calyci bilabiato differt.

The plant here segregated as f. *glabrescens* confirms the inclusion of this species in series Piurana. The upper surface of the leaflets are essentially glabrous and vernicose, and in their reflexed crisped-undulate margins they somewhat resemble the leaflets of *S. piurae*. The soft crinkly hairs of the lower surface of the leaflets, however, contrast markedly with the sharp pustulate hairs of *S. piurae*.

Forma *glabrescens* differs from typical *S. pampasense* not only in its essentially glabrous upper leaf-surfaces but also in its less pubescent stem, peduncle, pedicel and calyx. Also, the calyx is strongly bilabiate with the thickened lobes usually noticeably reflexed.

PERU: Dept. Apurimac, Prov. Abancay, Casinchihua, in crevices of old stone wall, 2,200 m. alt., annual herb to 0.3 m., corolla purple, Feb. 10, 1939, *H. E. Stork, O. B. Horton, C. Vargas C. 10577* (NA, type; F, G, isotypes).

Solanum suffrutescens Correll, sp. nov.

Planta suffrutescens, cum longis ramulis patulis; ramulorum caulis gracilis, teres, rubiginosus, glaber vel leviter puberulus; folia imparipinnata, brevia, cum compluribus parvis laminis inter foliola ex angustatis alis rachis ascendentibus; foliola septem usque ad novem, marginibus undulatis et leviter revolutis, supra vernicosa cum paucis crassis pilis, subtus pubescentia, pallido-viridia; foliola lateralia elliptica vel elliptico-lanceolata, acuta vel breviter apice acuminata, sessilia et in rachem folii basi obliqua paulum decurrentia; foliolum terminalum foliolis lateralibus simile; inflorescentia pauciflora; pedunculus brevis; pedicelli puberuli; supra medium articulati; lobi calycis leviter puberuli trilabiati cum aliquibus lobis partim conjunctis; corolla rotata; filamenta lata, paulum pubescentes; stylus gracilis, glaber; fructus subglobosi.

Plant apparently subshrubby, with spreading shoots up to 1.5 m. long, probably non-tuber-bearing; stem of shoots slender, terete, reddish brown, slightly woody, essentially glabrous to slightly puberulent; leaves odd-pinnate, short, up to 12 cm. long, mostly with several small interstitial leaflets arising from the narrow wings of the rachis; leaflets 7 or 9, sometimes slightly conduplicate, with scattered coarse hairs on the shiny dark green upper surface and more finely pubescent on the pale green lower

surface; lateral leaflets elliptic to elliptic-lanceolate, acute to shortly acuminate at apex, sessile and usually somewhat basiscopically decurrent on the rachis at the obliquely rounded base, with the margins somewhat undulate and lightly revolute, the lowermost pair or pairs smaller than the two uppermost pairs; terminal leaflet similar to the lateral ones; pseudostipular leaves semielliptic, falcate, up to about 1.5 cm. long; inflorescence pseudoterminal on branchlets, a few-flowered cymose panicle; peduncle short, up to about 3 cm. long, branched above; pedicels about 1.5 cm. long, articulate above the middle, reddish brown, puberulent; flowers light purple, showy; calyx 5–6 mm. long, purplish, puberulent, conspicuously and deeply trilabiate to below the middle, with two pairs of lobes partially united to form an attenuately bilobed apex to two of the segments (labia), the three lobes (or labia) ovate-elliptic to ovate-lanceolate; corolla rotate, 2–2.5 cm. in diameter; anthers lanceolate in outline, about 5.5 mm. long; filaments broad, somewhat pubescent (especially on margins), about 1.5 mm. long; style 8–9 mm. long, slender, glabrous; fruit (immature) subglobose, 1 cm. or more in diameter.

ECUADOR: Prov. Bolívar, road between Magdalena and Balzapamba, spreading suffrutescent shoots about 1.5 m. long, flowers light purple, showy, 2,800 m. alt., April 30, 1942, *Oscar Haught 3289* (US, type).

The subshrubby habit, short leaves with winged rachis, and peculiarly shaped calyx are some of the characteristics that distinguish this species.

SERIES TUBEROSA

Solanum Berthaultii Hawkes f. **zudanense** (Cárd.) Correll, comb. nov.

Solanum zudanense Cárd., Bol. Soc. Peruana Bot. 5: 31, *pl. III* (*A*), *figs. 1–3.* 1956.

This plant is more pubescent and the leaves are somewhat more dissected, especially in the number of interstitial leaflets, than in typical *S. Berthaultii*. Otherwise, I can find no difference in the two. The somewhat smaller white flowers are not critical since whitish flowers are also found in specimens of typical *S. Berthaultii*. Although Cárdenas states that the plant lacks glands, an examination of the type shows that it is as glandular as some plants of typical *S. Berthaultii*. The denser pubescence tends to hide the small capitate glands.

Solanum canasense Hawkes var. **neohawkesii** (Ochoa) Correll, comb. nov.

Solanum neohawkesii Ochoa, Rev. Argentina Agron. 19: 231, *figs. 1–2.* 1952 (not Vargas, Diez Años Servic. Bot. Univ. Cuzco 46. 1946, *nomen nudum*).

Variety *neohawkesii* is quite similar in habit to typical *S. canasense* although it has a tendency to become more branched and floriferous. Because of its attractive habit, combining its delicately and profusely dis-

sected leaves with their marginally undulate leaflets and the showy flowers it has possibilities as an ornamental plant, especially for border and mass plantings. This phase is now under investigation by Roman Ross at the Inter-regional Potato Introduction Station at Sturgeon Bay, Wisconsin.

The plant differs more or less by degrees from typical *S. canasense*. Its leaflets are usually more petiolulate and, as noted above, their margins are undulate and even somewhat pleated, and they are more elliptic or oval with a more or less cordate base and obtusish apex.

Solanum canasense var. **xerophyllum** (Vargas) Correll, comb. nov.

Solanum Lechnoviczii var. *xerophylla* Vargas, Las Papas Sudperuanas (Publ. Univ. Nac. Cuzco) 2: 61, *fig. 19*. 1956.

Variety *xerophyllum* differs from typical *S. canasense* in having the usually dark green, coriaceous and more or less vernicose upper leaf-surface glabrous or with only a few coarse, scattered hairs, and these mostly submarginal. Most of the material also has fewer interstitial leaflets than in typical *S. canasense*.

This plant shows a definite relationship with *S. marinasense* and, with further collecting and study, it might prove to be either a narrow-leaflet variety of that species or a hybrid of that species with *S. canasense*. One of the three plants of an isotype in the Lundell Herbarium has the uppermost pair of lateral leaflets strongly decurrent on the leaf-rachis.

Solanum chavinense Correll, sp. nov.

Planta erecta vel fruticosa, omnino pubescens cum longis crassis pilis, stolonifera et tuberifera; tubera globosa vel ellipsoidea, alba, crispa; caulis gracilis, simplex vel ramosus, cum pilis longis patulis; folia imparipinnata, pubescentia, cum pilis longis crassis, rache alata; foliola lateralia late elliptica vel suborbicula, obtusa vel acuta, sessilia et folioli rache decurrentia, cum foliola terminali quam foliolis lateralibus multo majore; inflorescentia pauci- vel multi-flora; pedicelli graciles, crasse pubescentes, super medium prominenter articulati; flores grandes et monstrati; calycis lobi ovato-lanceolati, acuti vel acuminati; corolla late stellata vel rotato-stellata; filamenta gracilia, glabra; stylus infra cellulo-papillosus, stigma capitatum; fructus ovoideo-ellipsoidei vel subglobosi, compressi.

Plant erect or occasionally bushy, up to 6 dm. tall, usually much shorter, more or less pubescent throughout with coarse hairs, stoloniferous and tuber-bearing; tubers globular to ellipsoid, white, brittle, up to 4 cm. long; stem slender, adorned with long spreading hairs, simple or sometimes branched; leaves odd-pinnate or rarely with some simple, without interstitial leaflets, pubescent on both surfaces with long shaggy hairs, up to 18 cm. long, with the rachis prominently winged; leaflets 3 to 5 or rarely 7 (when not simple); terminal leaflet greatly exceeding in size the adjacent lateral pair, broadly elliptic to suborbicular, obtuse to abruptly acute at

apex, cuneate at base, up to 12 cm. long and 6 cm. wide; lateral leaflets elliptic, obtuse to subacute at apex, sessile and basiscopically long-decurrent on the leaf-rachis, up to 6 cm. long and 2.5 cm. wide, the lower pair of leaflets (when present) greatly reduced; pseudostipular leaves semielliptic, falcate, up to 2.5 cm. long; inflorescence pseudoterminal, a few- to many-flowered cymose panicle; peduncle short, mostly less than 4 cm. long, branched above; pedicels up to 3 cm. long, slender, coarsely pubescent, prominently articulate well above the middle; flowers usually large and showy, lavender to purplish; calyx 7–10 mm. long, divided to about or below the middle into ovate-lanceolate acute to acuminate lobes, coarsely pubescent, usually with purple pigment; corolla broadly stellate to rotate-stellate, 3–4.5 cm. in diameter; anthers broadly lanceolate in outline, 6–7.5 mm. long; filaments slender, glabrous, 2–3 mm. long; style about 1 cm. long, cellular-papillose below the middle, the stigma usually noticeably capitate; fruit ovoid-ellipsoid to subglobose, somewhat compressed, up to about 2 cm. long.

PERU: Dept. Ancash, among boulders and trees near pass between Recuay and Chavín, 4,200 m. alt., flowers lavender to purple, corolla broadly stellate, fruits oblong, March 30, 1960, *D. S. Correll & E. E. Smith P973* (LL, type).

The conspicuously basiscopically decurrent lateral leaflets, winged leaf-rachis, long straggly hairs on stem and leaf-rachis, and basic difference in the shapes of their corollas set this species apart from the allied and poorly defined *S. dolichocremastrum* Bitt.

Solanum chavinense has some resemblance to the Colombian *S. Flahaultii* Bitt. as well as to *S. medians* Bitt., *S. Weberbaueri* Bitt. and *S. tacnaense* Ochoa. Its differently shaped corolla sets it apart from those species and its non-conical fruit further separates it from *S. Flahaultii*.

Solanum Doddsii Correll, sp. nov.

Planta ramosissima et patens, omnino glabra (foliolorum marginibus exceptis), stolonifera; tubera ignota; caulis brevis, acriter flexuosus, sine alis; folia imparipinnata sine vel cum paucis laminis inter foliola; foliola septem usque ad novem, prominenter petiolulata, marginibus serrulato-pubescentibus, ovato-elliptica vel elliptico-lanceolata, acuta vel apice breviter acuminata, basi subcordata; inflorescentia multiflora; pedunculus brevis; pedicelli filiformes, supra medium articulati, supra articulatum in calyce dilatati; lobi calycis basi subquadrati, supra longo-attenuati; corolla stellata; filamenta glabra; stylus gracilis, glaber; fructus ovoideo-globosi.

Plant bushy and spreading, essentially glabrous throughout except for the minutely serrulate-pubescent margins of the leaflets, stoloniferous and probably tuber-bearing; tubers unknown; stem abbreviated, zig-zag, wingless; leaves odd-pinnate, up to 21 cm. long, without or with several small interstitial leaflets; leaflets 7 to 11, long-petiolulate (to 1 cm.), with serrulate-pubescent margins; lateral leaflets ovate-elliptic to elliptic-lanceolate, acute to shortly acuminate at apex, subcordate at the very oblique base,

up to 7 cm. long (including petiolule) and 3 cm. wide; terminal leaflet only slightly wider than the lateral ones; pseudostipular leaves semiovate, falcate, up to about 1 cm. long; inflorescence pseudoterminal, a many-flowered cymose panicle; peduncle slender, short, up to 4.5 cm. long, branched above; pedicels filiform, 2–3 cm. long, articulate above the middle, slightly dilated into the calyx above the articulation; flowers light lavender; calyx 8–10 mm. long, divided to about the middle into basally subquadrate abruptly long-attenuate lobes; corolla stellate, about 3 cm. in diameter; anthers 8 mm. long, lanceolate in outline; filaments stout, glabrous, about 1.5 mm. long; style slender, about 1.1 cm. long, glabrous; fruit ovoid-globose, 1 cm. or more long.

BOLIVIA: Dept. Cochabamba, on rocky wooded slope at Km. 192 from Sucre, 44 km. from Aiquile, leaves essentially glabrous, flowers light lavender, February 15, 1960, *D. S. Correll, K. S. Dodds, E. H. Brücher & G. J. Paxman B616* (LL, type).

The glabrousness of the plant (with the exception of serrulate-pubescent margins of the leaflets), the exceedingly slender pedicels, the long-attenuate lobes of the calyx, and the stellate corolla are a combination of characteristics that not only compares it to, but distinguishes it from, such species as *S. Berthaultii* Hawkes and *S. tarijense* Hawkes, which it superficially resembles.

It is a pleasure to name this species for Dr. K. S. Dodds, the distinguished Director of the John Innes Institute, Bayfordbury, England, who kindly included me in his party on a trip through central Bolivia and northwest Argentina.

Solanum Fendleri A. Gray var. **texense** Correll, var. nov.

Planta alta, expansa; inflorescentia dense pubescens pilis griseo-albis; flores albi vel violaceo-tincti; corolla stellata, lobis angustibus et acutis; calyx irregulatim et profunde lobatus.

Variety *texense* is a taller and more open plant than typical *S. Fendleri*. The inflorescence, especially the calyx, is grayish in color which is caused, in part, by the dense grayish white pubescence. The white to light lavender-white corolla is more deeply lobed, with narrower and more acute acumens, and the calyx is irregularly and more deeply lobed than in typical *S. Fendleri*. It is quite possible that with additional material this variety may prove to be specifically distinct from *S. Fendleri*.

UNITED STATES: Texas, Jeff Davis County, infrequent along stream, Little Aguja Canyon near Calf Slide, Buffalo Trail Scout ranch, Davis Mountains, 1,650 m. alt., August 8, 1948, *B. H. Warnock & B. L. Turner 8058* (LL, type).

Solanum hastiformum Correll, sp. nov.

Planta erecta vel erecto-ascendens, omnino valde et crasse pubescens, prominenter stolonifera et tuberifera; stolones plantas filiales producentes; tubera minuta; folia integra vel cum unis vel duobus minutis lobulis

auriculatis in basi vel paululum infra basim cuneatum ornata, foliis hastatis visis, prima lamina ovata vel elliptica et subobtusa vel acuta; inflorescentia pauciflora; pedicelli longi, paululum infra calycem articulati, pilis albis acutis valde pubescentes; calycis lobi triangularo-lanceolati, acuminati, saepe bilabiati; corolla rotato-pentagona; filamenta lata, glabra; stylus minute cellulo-papillosus.

Plant erect to erect-ascending, up to about 2.5 dm. tall, rather densely and coarsely pubescent throughout, conspicuously stoloniferous and tuber-bearing, with the stolons giving rise to daughter plants; tubers minute, ellipsoid, less than 5 mm. long; stem rather stout, simple or branched at base, straight or zigzag; leaves simple or with one or two minute auriculate lobules developed on or just below the cuneate base to make the leaves appear halberd-shaped, up to 8 cm. long (including the petiole) and 3.5 cm. wide, the primary blade ovate to elliptic and subobtuse to acute at apex, the lateral lobules elliptic and up to 1 cm. long; pseudostipular leaves semielliptic, broadly falcate, up to about 1 cm. long; inflorescence pseudo-terminal, about 4-flowered; peduncle short, less than 1 cm. long; pedicels 2–5 cm. long, articulate usually about 5 mm. below the calyx, densely pubescent with sharp white hairs; flowers purple-lavender; calyx 6–8 mm. long, divided to below the middle into triangular-lanceolate acuminate lobes, usually somewhat bilabiate; corolla rotate-pentagonal, about 3 cm. in diameter; anthers broadly lanceolate in outline, 5–6 mm. long; filaments broad, glabrous, 1–2 mm. long; style 7–10 mm. long, rather stout, minutely cellular-papillose; fruit (immature) broadly ovoid.

PERU: Dept. La Libertad, along brushy-rocky stream about 3 km. west of Huamachuco, 3,200 m. alt., flowers purple-lavender, rotate-pentagonal, tubers small, March 27, 1960, *D. S. Correll & E. E. Smith P930* (LL, type).

The presence of one or two lateral auriculate lobules on most of the leaves distinguishes this species. The plant is also heavily pubescent with long coarse hairs.

Solanum leptophyes Bitt. f. **Gourlayi** (Hawkes) Correll, comb. nov.

Solanum Gourlayi Hawkes, Bul. Imp. Bur. Pl. Breed. & Genet., Cambridge 43, 120, *fig. 27*. 1944.

Forma *Gourlayi* graduates from typical *S. leptophyes* in being usually less pubescent and in having somewhat broader leaflets and few or usually no interstitial leaflets. The lateral leaflets are also usually, but not always, more or less decurrent on the leaf-rachis. In this latter characteristic it shows some resemblance to *S. infundibuliforme* of series Cuneoalata.

Solanum limense Correll, sp. nov.

Planta laxa, omnino plurimum glabra; tubera ignota; caulis gracilis, ramosus; folia imparipinnata, laxa, cum compluribus laminis orbiculatis inter foliola; foliola prominenter petiolulata, elliptica, obtusa vel acuta;

inflorescentia pauciflora; pedicelli graciles, prope medium articulati; calycis lobi subquadrati, apiculati; corolla stellata; filamenta glabra; stylus gracilis, glaber.

Plant lax, 3 dm. or more tall, probably tuber-bearing, glabrous throughout except for sparse pubescence on both surfaces of the leaflets; tubers unknown; stem slender, glabrous, branched; leaves odd-pinnate, slender, lax, usually with several small stalked orbicular interstitial leaflets, up to 17 cm. long; leaflets 9 or 11, with prominent slender naked petiolules up to 5 mm. long; lateral leaflets elliptic, obtuse to abruptly long-acute at apex, broadly rounded to somewhat cordate at the oblique base, up to 3.5 cm. long and 1.5 cm. wide; terminal leaflet usually a little broader and larger than the lateral ones; pseudostipular leaves semiovate, falcate, about 8 mm. long; inflorescence pseudoterminal or lateral, cymosely paniculate, glabrous, about 15-flowered; peduncle slender, about 7 cm. long, branched above; pedicels slender, 1–2 cm. long, glabrous, articulate at about the middle; flowers apparently whitish (not noted); calyx 2.5–4 mm. long, divided to about the middle into subquadrate short-apiculate lobes; corolla stellate, 2–2.5 cm. in diameter, the acumens prominent; anthers linear-oblong in outline, 4–6 mm. long; filaments glabrous, about 1 mm. long; style slender, glabrous, about 1 cm. long, the stigma elongate-cylindric; fruit unknown but the ovary ovoid.

PERU: Dept. Lima, January 1948, *J. Soukup 3555* (F, type; US, isotype).

Except for the fewer interstitial leaflets, the leaves of this species resemble somewhat those of *S. Abbottianum*. It is, however, a more lax, weak plant, being slender throughout. This species has several distinctive features. It is glabrous except for a thin pubescence on both surfaces of the leaflets, the corolla is stellate, and the calyx is minute.

Solanum Lobbianum Bitt. f. **multidissectum** (Hawkes) Correll, comb. nov.

Solanum multidissectum Hawkes, Bul. Imp. Bur. Pl. Breed. & Genet., Cambridge 49, 124, *fig. 38*. 1944.

Forma *multidissectum* is superficially different from typical *S. Lobbianum* in usually having more numerous two- to several-sized interstitial leaflets.

Solanum macropilosum Correll, sp. nov.

Planta erecta vel laxo-ascendens, stolonifera et tuberifera; tubera parva, ellipsoidalia; caulis flexuosus, subglaber vel longo-pilosus; folia imparipinnata vel raro integra, brevia sine laminis inter foliola, utrimque valde pilosa, pilis crassis; foliolum terminale et par superum foliolorum lateralium magnum, pari infimo multo redacto; inflorescentia pauciflora; pedicelli in medio vel paululum infra medium articulati; calycis lobi ovato-lanceolati, abrupte acuti vel attenuati, valde pilosi; corolla magna, late rotato-pentagona; filamenta glabra; stylus gracilis.

Plant erect or laxly ascending, 1–4 dm. tall, stoloniferous and tuber-

bearing; tubers small, ellipsoid, the only one present is 1 cm. long; stem simple, slender, more or less fractiflex (zigzag) above, subglabrous to sparsely long-pilose; leaves odd-pinnate or rarely simple, abbreviated, up to 13 cm. long, usually 8 cm. or less long, without interstitial leaflets, densely pilose on both surfaces with long coarse hairs, with a short petiole mostly less than 3 cm. long; leaflets 3 or 5, the second pair of lateral leaflets (when present) greatly reduced; terminal leaflet broadly rhombic-ovate to elliptic-lanceolate, acuminate at apex, broadly rounded to subtruncate at the slightly oblique base, up to 8 cm. long and 4 cm. wide; lateral leaflets (upper pair) sessile to shortly petiolulate, elliptic to elliptic-lanceolate, acute to shortly acuminate at apex, rounded at the oblique base, up to 5 cm. long and 2.3 cm. wide, usually much smaller, the lowermost pair (when present) similar to the upper pair but greatly reduced; inflorescence pseudo-terminal, few-flowered; peduncle slender, up to 4 cm. long, sparsely long-pilose; pedicels 1.5–2 cm. long, articulate at about or just below the middle; flowers lavender; calyx 4–6 mm. long, divided to about or below the middle into ovate to ovate-lanceolate abruptly acute to attenuate lobes, rather densely long-pilose; corolla broadly rotate-pentagonal, 3.5–4 cm. in diameter; anthers 4.5–6 mm. long, oblong-lanceolate in outline; filaments glabrous, about 2 mm. long; style slender, about 1 cm. long, stigma rather abruptly clavellate; fruit (immature) globose, 8 mm. long.

MEXICO: Nuevo León, Cerro del Viejo, 15 miles west of Dulces Nombres, Municipality of Zaragoza; tuberous-rooted perennial to 8 inches tall; flowers lavender, on limestone boulders in open pine woods, 3,330 m. alt., August 18, 1948, *F. G. Meyer & D. J. Rogers 2968* (G, type; E, MO, isotypes).

The distinctively 3-leaflet aspect, with the terminal leaflet conspicuously enlarged, and the long, coarse, shaggy hairs separate this species from all others known from Mexico. It resembles *S. Wightianum* Rydb. to some extent, and it also superficially resembles the South American *S. Flahaultii*.

Solanum medians Bitt. var. **autumnale** Correll, var. nov.

Foliola lateralia quattuor usque ad octo, angustiora quam in typico *S. medians*; stylus vulgo glaber; planta autumna non vernalis florens.

Although the leaves of var. *autumnale* usually have the 3-leaflet aspect of typical *S. medians*, they may have as many as four pairs of lateral leaflets. The leaflets are, on the whole, narrower than in typical material and the styles are usually glabrous.

The autumn (Southern Hemisphere), instead of spring, flowering period of var. *autumnale* during March and April, and its occurrence at from 1,800 to nearly 4,000 meters altitude instead of in the loma vegetation zone are noteworthy differences.

This is the second instance that I know of where plants that are otherwise basically similar are found at different times of the year at different elevations. In the case of *S. immite* and its var. *vernale*, typical material flowers in

the fall at high elevations while the var. *vernale* flowers in the spring in the coastal loma vegetation zone. These two examples pose still another problem yet to be fully explored and solved in this complicated group of plants.

It is quite possible that var. *autumnale* represents the northern extension of a montane linkage between the southern *S. tacnaense* Ochoa complex and the *S. medians* complex centered in Lima Department, Peru. There is no question, whatsoever, concerning the close inter-relationship of these two groups of plants. It resolves itself into the necessity of recognizing some rather poorly defined entities or grouping them into a single highly variable, widespread megaspecies.

PERU: Dept. Lima, Prov. Huarochiri, valley of Río Rimac, above highway Lima-Oroya at Km. 70, east of Lima, in moist crevices of rock walls, plant prostrate, 1,850 m. alt., April 21–26, 1942, *T. H. Goodspeed 33116* (GH, type; F, MO, US, isotypes).

Solanum medians f. **neoweberbaueri** (Wittm.) Correll, comb. nov.

Solanum neoweberbaueri Wittm., Engl. Bot. Jahrb. 50 (Suppl.): 540, *figs. 1–2.* 1914.

Solanum medians f. *neoweberbaueri* is quite similar to the typical form. The upper pair of lateral leaflets, however, have broadly winged petiolules that are somewhat decurrent on the leaf-rachis and the peduncle and pedicels are less pubescent. The leaves also often have one or more small interstitial leaflets.

Solanum minutifoliolum Correll, sp. nov.

Planta crassa, valde pilosa et omnino paulum glandulosa, stolonifera; folia imparipinnata; foliola quinque cum pari infimo multo redacto, elliptica vel elliptico-lanceolata; petioli rachisque superus latus cum crebis laminis subimbricatis inter foliola; inflorescentia multiflora; pedicelli crassi, in medio prominenter articulati, valde hirsuti; calycis lobi ovato-subquadrati, longo-apiculati; corolla stellata; filamenta lata, basi quibusque lateribus comosis; stylus cellulo-papillosus.

Plant coarse, stout, erect or weakly ascending, densely pilose and somewhat glandular throughout, up to 1 m. tall, stoloniferous and apparently giving rise to new plants by these; tubers (if produced) unknown; stem weak but thick, lightly winged, apparently reddish brown; leaves odd-pinnate, thickish, up to 33 cm. long, the upper side of petiole and rachis usually provided with numerous subimbricated several-sized small (often minute) suborbicular to obovate interstitial leaflets; leaflets 3 or usually 5, dark green and coarsely pubescent on upper surface (especially on midveins), pale green and more finely and densely pubescent on lower surface; lateral leaflets subsessile or with a short winged petiolule, elliptic to elliptic-lanceolate, rounded at the oblique base, acute to abruptly short acuminate at apex, up to 13.5 cm. long and 6.5 cm. wide, the lowermost pair greatly

reduced or almost obsolete; terminal leaflet broader and longer than the adjacent pair of lateral leaflets; pseudostipular leaves suborbicular, falcate, about 1.5 cm. long; inflorescence lateral on the branches, many-flowered; peduncle stout, up to 7 cm. long, pubescent, branched above; pedicels stout, about 1.5 cm. long, prominently articulate at about the middle or sometimes on either side of middle, densely hirsute; flowers purple or indigo-blue; calyx 7–10 mm. long, densely pubescent, divided to about or below the middle into ovate-subquadrate lobes that are abruptly contracted to form a long-apiculate apex; corolla stellate, about 2.5 cm. in diameter; anthers oblong-lanceolate in outline, 6–7 mm. long; filaments broad, 1–1.5 mm. long, with a tuft of hairs on each side at base; style about 9 mm. long, cellular-papillose, the stigma not noticeably enlarged; fruit unknown but the ovary is broadly ovoid.

ECUADOR: Prov. Tungurahua, near Baños, weak-stemmed herb, 65 cm. high; flowers purple, open land, 1,200–1,500 m. alt., February 26, 1935, *Ynes Mexia 6997* (US, type; NA, isotype).

The large terminal leaflet and upper pair of lateral leaflets that give the leaf a 3-leaflet aspect, and the numerous small several-sized subimbricate interstitial leaflets, as well as broadly stellate corolla, make this a most distinctive species.

Solanum multiinterruptum Bitt. f. **longipilosum** Correll, forma nov.

Planta similis typico *S. multiinterruptum* est, sed longos albos laxos pilos imprimis in caule, in folii rache, in pedunculis et pedicellis atque crebriores capitatas glandis habet.

Those plants that have long, whitish, lax hairs throughout the plant but primarily on their stems, leaf-rachises, peduncles and pedicels, as well as scattered but noticeable capitate glands make up this form.

PERU: Dept. Ancash, Prov. Bolognesi, above Chiquián, brow of hill on edge of farm, 3,500–3,600 m. alt., March 31, 1937, *Ramón Ferreyra & E. Cerrate 12131* (LL, type; USM, isotype).

Solanum orophilum Correll, sp. nov.

Planta erecta, robusta, omnino pubescens et paulum glandulosa (praesertim inflorescentia et subtus folia glandulosa), stolonifera; tubera ignota; caulis robustus, integer vel ramosus, sine alis, cum maculis purpureis; folia imparipinnata, cum paucis laminis inter foliola; foliola novem usque ad undecim; foliola lateralia sessilia vel brevi-petiolulata, elliptica vel elliptico-lanceolata, acuta vel apice abrupte brevi-acuminata, basi obliqua rotundata vel subcordata, cum pari infimo redacto; foliolum terminale quam foliolis lateralibus parvulum maius, raro rhombico-lanceolatum; inflorescentia multiflora; pedicelli supra medium vel paululum sub calyci articulati; lobi calycis ovato-subquadrati et abrupte longe-acuminati; corolla rotata; filamenta glabra; stylus glaber; fructus globulares.

Plant erect, robust, up to 7.5 dm. or more tall, pubescent throughout and somewhat glandular (especially the inflorescence and lower leaf-surfaces), stoloniferous and probably tuber-bearing; tubers unknown; stem stout, simple or branched, wingless, commonly mottled with purple; leaves odd-pinnate, up to 22 cm. long, with several interstitial leaflets; leaflets 9 or 11; lateral leaflets sessile to very shortly petiolulate, elliptic to elliptic-lanceolate, acute to abruptly short-acuminate at apex, broadly rounded to subcordate at the oblique base, up to 6 cm. long and 2.5 cm. wide, the lowermost pair or pairs much reduced; terminal leaflet only slightly larger than the lateral ones, often rhombic-lanceolate; pseudostipular leaves semiovate, falcate, up to 1.5 cm. long; inflorescence pseudoterminal, a many-flowered cymose panicle; peduncle usually short, up to 9 cm. long, branched above, glandular-pubescent; pedicels about 1.5 cm. long, glandular-pubescent, articulate well above the middle; flowers lavender-purple; calyx 7–10 mm. long, glandular-pubescent, divided to below the middle into ovate-subquadrate abruptly long-acuminate lobes, occasionally 6-lobed; corolla rotate-pentagonal or sometimes rotate-hexagonal, rarely rotate-substellate, the acumens rather abruptly narrowed, 2.5–4 cm. in diameter; anthers lanceolate in outline, 6–7 mm. long; filaments about 1 mm. long, glabrous; style about 1 cm. long, glabrous, the stigma capitate; fruit globular, about 1.5 cm. in diameter.

PERU: Dept. Ancash, on rocky-brushy slope, several km. above Chavín, 3,500 m. alt., flowers lavender-purple, reflexed, March 30, 1960, *D. S. Correll & E. E. Smith P971* (LL, type).

This species superficially resembles *S. violaceimarmoratum* Bitt., but its globular, not ovoid-conic, fruit readily separates it from that species. It is of interest that some flowers occur which have six instead of the usual five acumens and an extra calyx lobe which is fused with another.

Solanum puberulofructum Correll, sp. nov.

Planta herbacea, fructicosa, omnino plusminusve pubescentia, stolonifera; tubera ignota; caulis robustus, teres, aliquid sinuatus, plurimum cum compluribus ramis; folia imparipinnata cum crebis laminis inter foliola; foliola novem usque ad quindecim plurimum petiolulata, lanceolata vel lineari-elliptica vel lineari-lanceolata, obtusa vel acuminata; inflorescentia laxe pauciflora; pedicelli graciles, circiter in medio articulati, pubescentes et vulgo glandulosi; flores violacei vel albi; calycis lobi ovati abrupte acuminati, saepe bilabiati; corolla rotato-pentagona; filamenta robusta, glabra; stylus robustus, infra medium cellulo-papillosus; fructus subglobosi vel late ovoidei, apiculati, dense puberuli.

Plant low and bushy, more or less pubescent throughout, stoloniferous and doubtlessly tuber-bearing; tubers (unknown); stem stout, terete, somewhat sinuous, mostly several-branched; leaves odd-pinnate, up to 17 cm. long, with numerous interstitial leaflets, coarsely and sparsely pubescent on the dark green upper surface, more finely pubescent on the lighter green

lower surface; leaflets 9 to 15; lateral leaflets petiolulate or frequently with the uppermost pair sessile and sometimes decurrent on the leaf-rachis, lanceolate to linear-elliptic or linear-lanceolate, obtuse to shortly acuminate at apex, narrowly cuneate at base, up to 6.5 cm. long and 1.5 cm. wide; terminal leaflet rarely slightly wider than the lateral ones; pseudostipular leaves semielliptic, falcate, up to about 1.5 cm. long, commonly lobed near the base; inflorescence pseudoterminal and/or lateral, a rather laxly few-flowered cymose panicle; peduncle slender, up to 5 cm. long, branched above; pedicels slender, 2–2.5 cm. long, articulate at about the middle, pubescent and usually also glandular; flowers violet-color to rarely whitish; calyx 5–7 mm. long, divided to about or slightly below the middle into ovate abruptly acuminate lobes, often bilabiate; corolla rotate-pentagonal, up to about 3 cm. in diameter; anthers ellipsoid-lanceolate in outline, 5–6 mm. long; filaments stout, about 1 mm. long, glabrous; style stoutish, 9–11 mm. long, cellular-papillose on the lower half; fruit subglobose to broadly ovoid, apiculate, densely puberulent, up to 2 cm. long.

ARGENTINA: Prov. Catamarca, Dept. Belén, Pozo de Piedra, dry places in loess, 1,900–2,000 m. alt., flowers violet-color or whitish violet, leaves narrow, January 25–31, 1952, *H. Sleumer & F. Vervoorst 2435* (LL, type; G, S, US, isotypes).

As far as I know, this is the only species of *Solanum* in the section Tuberarium that has densely puberulent apiculate fruits. It is this characteristic, plus its rotate-pentagonal corolla, that keeps it apart from *S. setulosistylum* Bitt.

Plants included here and those which I consider to be referable to *S. setulosistylum* are essentially identical in habit.

Solanum regularifolium Correll, sp. nov.

Planta herbacea, ramosissima, omnino pubescens; tubera globosa; caulis gracilis, flexuosus, alatus, cum pilis longis sparsis; folia imparipinnata, sine laminis inter foliola; rachis cum pilis longis sparsis; foliola septem usque ad undecim, sessilia vel brevissime petiolulata, pubescentia, elliptica vel elliptico-lanceolata, obtusa vel subacuta; inflorescentia pauciflora, racemosa; pedicelli graciles, supra medium articulati; lobi calycis ovati, abrupte longo-apiculati, pubescentes cum pilis longis; corolla rotato-stellata; filamenta glabra; stylus gracilis, infra medium cellulari-papillosus.

Plant low and bushy, more or less pubescent throughout, stoloniferous and tuber-bearing; tubers globose, up to 3 cm. in diameter; stem slender, flexuous, mostly undulately winged and with scattered long silvery hairs; leaves odd-pinnate, oblanceolate in outline, without interstitual leaflets, the rachis with scattered long hairs; leaflets 7 to 11, usually 9, very regularly and simply arranged on the rachis, with long coarse hairs on the upper surface, more finely and densely pubescent on the lower surface; lateral leaflets sessile to very shortly petiolulate, the uppermost pairs slightly basiscopically decurrent on the leaf-rachis, elliptic to elliptic-lanceolate,

obtuse to subacute at the apex, broadly cuneate to rounded at the oblique base; terminal leaflet only slightly larger than the lateral ones; pseudostipular leaves semiovate, falcate, less than 1 cm. long; inflorescence pseudoterminal, several-flowered and racemose; peduncle slender, short, about 2 cm. long, sparingly pubescent; pedicels slender, about 2 cm. long, with scattered long hairs, articulate well above the middle; flowers pinkish lavender; calyx 5–6 mm. long, divided to about the middle into ovate abruptly long-apiculate lobes, rather densely pubescent with long white hairs; corolla rotate-stellate, about 2.5 cm. in diameter; anthers 5–6 mm. long, lanceolate in outline; filaments 1.5–2 mm. long, glabrous; style slender, about 1 cm. long, cellular-papillose on lower half, the stigma only slightly globose; fruit unknown.

ECUADOR: Prov. Chimborazo, on brushy slope near river, just south of Guasuntos, plant low, bushy, flowers pink-lavender and rotate-stellate; tubers round, up to 3 cm. in diameter, March 13, 1958, *D. S. Correll & G. Albornoz P. E335* (LL, type).

The simplicity of this plant is perhaps its most distinctive characteristic. It is a low, compact plant with closely placed leaves that have regularly shaped and arranged leaflets and no interstitial leaflets. The undulately winged flexuous stem and rotate-stellate corolla are also distinctive.

Solanum rhomboideilanceolatum Ochoa var. **ancophilum** Correll, var. nov.

Planta similis typico *S. rhomboideilanceolatum* sed folia densius pubescentia et vulgo breviora et foliola angustiora sunt.

The var. *ancophilum* differs from typical *S. rhomboideilanceolatum* in being more densely pubescent and in frequently having shorter leaves with narrower leaflets. Otherwise, the flowers and general characteristics of the plant are quite similar in the two entities.

PERU: Dept. Ancash, among large boulders in gorge of glacial valley on northwest slope of Nevada de Huascarán, below Llanganuco, 3,500 m. alt., March 29, 1960, *D. S. Correll & E. E. Smith P957* (LL, type; UC, US, isotypes).

Solanum Sleumeri Correll, sp. nov.

Planta fruticosa, laxe erecta vel adscendens, subglabra vel sparsim pubescens vel puberula, stolonifera; tubera ignota; caulis gracilis, integer vel ramosus, sine alis; folia imparipinnata cum crebis laminis inter foliola; foliola novem usque ad undecim, prominenter petiolulata, cum paribus lateralibus distantibus, elliptica vel anguste elliptico-lanceolata vel lineari-lanceolata, obtusa vel acuminata; inflorescentia multiflora; pedunculus elongatus; pedicelli circiter in medio vel propre calycem prominenter articulati; flores violacei; calycis lobi ovato-quadrati, abrupte longo-apiculati; corolla rotato-pentagona vel rotato-substellata; filamenta

glabra, saepe partim conjuncta; stylus infra medium papulosus; fructus probabiliter ovoidei.

Plant bushy, up to 5 dm. or more tall, subglabrous to more or less sparsely pubescent or puberulent throughout, laxly erect or ascending, stoloniferous and doubtlessly tuber-bearing; tubers unknown; stem rather slender, simple or branched, sometimes zig-zag, essentially wingless; leaves odd-pinnate, up to 32 cm. long, shortly petioled, with numerous several-sized elliptic interstitial leaflets; leaflets 9 or 11; lateral leaflets prominently petiolulate, with the pairs rather widely spaced, ellipitc to narrowly elliptic-lanceolate or linear-lanceolate, obtuse to acuminate at apex, cuneate at the asymmetrical base, up to 9 cm. long and 3 cm. wide, with the petiolule up to 1 cm. long and frequently with secondary leaflets; terminal leaflet similar to the lateral leaflets but usually slightly larger; pseudostipular leaves elliptic, falcate, up to about 1.5 cm. long; inflorescence pseudoterminal, cymosely paniculate, usually many-flowered (as many as 35); peduncle up to 12 cm. long, branched above; pedicels 2.5–3.5 cm. long, prominently articulate well above the middle or sometimes at about the middle or just below the calyx; flowers violet-color; calyx 7–11 mm. long, divided to about the middle into lobes that are typically ovate-quadrate below and abruptly contracted above to form an elongate ligulate apical portion; corolla rotate-pentagonal to rotate-substellate, 2.5–3 cm. in diameter; anthers lanceolate in outline, 6–7.5 mm. long; filaments 1–2 mm. long, glabrous, sometimes partly united above their attachment to the corolla; style 9–12 mm. long, papillose below the middle; fruit purplish green, apparently avoid.

ARGENTINA: Prov. Catamarca, Dept. Belén, km. 15–18 along road, Pozo de Piedras, 1,900–2,000 m. alt., January 25–31 (and February 2), 1952, *H. Sleumer & F. Vervoorst 2434* (LL, type; G, LIL, S, UC, US, isotypes).

The long lax leaves with rather widely spaced, narrow, conspicuously petiolulate lateral leaflets distinguish this plant. The leaves remarkably resemble Ochoa's illustration of a leaf of his *S. multiinterruptum* var. *machaytambinum* from La Libertad Dept., Peru, but these two entities are otherwise quite dissimilar.

Solanum tacnaense Ochoa var. **Sandemanii** (Hawkes) Correll, comb. nov.

Solanum Sandemanii Hawkes, Annals and Mag. Nat. Hist., ser. 12, 7: 709, *figs. 12–13*. 1954.

Variety *Sandemanii* differs from typical *S. tacnaense* in having narrower tapering leaflets, with the upper lateral pair conspicuously narrowly long-decurrent on the leaf-rachis. Also the calyx-lobes tend to be more constricted with the apical portion much narrower.

A plant of var. *Sandemanii* (*Vargas No. 8086*) has pedicels that are articulate at the very base. This phenomenon occurs in other species, however, whose pedicels are also normally articulate at about the middle or well above the base. Some sheets of the type collection of *S. Sandemanii*

have extremely elongate floral branches in which small leaves are found to near their tips. These are not actual floral bracts but represent an apparent mix-up of a floral branch and leafy stem.

Solanum tacnaense f. **decurrentialatum** (Ochoa) Correll, comb. nov.

Solanum Weberbaueri Bitt. var. *decurrentialatum* Ochoa, Agronomía (Lima) 26: 219, *figs.* 1959.

In originally describing this plant, Ochoa placed it as a variety of *S. Weberbaueri*, a plant that occurs in the coastal loma vegetation of Peru and flowers from July to November. The present plant occurs at 3,200 m. alt., and flowers in March. Besides these altitudinal and seasonal differences, the broadly decurrent uppermost pair of lateral leaflets are quite distinctive. Some plants, however, of *S. Weberbaueri* do show a weak tendency toward this latter characteristic, especially in the plant described as *S. Weberbaueri* var. *poscoanum* Cárd. & Hawkes.

Forma *decurrentialatum* approaches var. *Sandemanii*, but the differently shaped subsessile terminal leaflet and more closely placed somewhat broader and more strongly decurrent lateral leaflets set it apart.

SERIES UNDETERMINED

Solanum Pennellii var. **puberulum** Correll, var. nov.

Planta in habitu typico *S. Pennellii* similis sed puberula est et foliorum margines integri vel subintegri sunt.

If the basic design and habit of the plant and flowers did not follow so closely that of typical *S. Pennellii* the var. *puberulum* might readily be separated as a distinct species. Outwardly, it differs rather markedly from typical material, and at first I considered it to be a distinct species to the extent of having an illustration prepared. As its name implies, the plant is puberulous instead of being densely glandular-pubescent. According to Ferreyra, the succulent leaves, when fresh, are shining ("brillantes"). The leaflets also have entire rather than crenate or coarsely dentate margins. This plant apparently represents an extreme condition in this rather highly variable species.

PERU: Dept. Ica, Prov. Nazca, dry river-bed between Nazca and Palpa, sandy-rocky soil, 500–600 m. alt., December 21, 1959, *Ramón Ferreyra 14028* (LL, type; AHUC, USM, isotypes).

I wish to acknowledge that this is a part of the project on the section Tuberarium of *Solanum* which is being supported, in part, by a grant (NSF-G4440) from the National Science Foundation.

A NEW ANNUAL PHLOX

Edgar T. Wherry

A recent review of the specimens of *Phlox* in the herbarium of Texas Research Foundation disclosed the existence of a hitherto unrecognized annual in Kent County, Texas, which lies *ca.* 100 miles northwest of the locality of any member of the group thus far known. It is herewith named in honor of the late Ivan M. Johnston, one of its collectors.

Phlox Johnstonii Wherry, sp. nov.

Planta annua, ramosa, usque ad 30 cm. alta, tota glandulosa. Folia angusto-elliptica vel oblongo-lanceolata, infra 30 mm. longa. Sepala 8–10 mm. longa, ⅜ ad ½ longitudine conjuncta, brevi-aristata. Tubus corollae gracilis, 18–20 mm. longus, glandulosus; lamina petali obovata, apiculata, 9–11 mm. longa, 7–9 mm. lata, rosea, oculo pallido. Styli 2–3 mm. longi, circa ½ longitudine conjuncti.

Plant annual, up to 30 cm. high, often several-branched at base and bearing alternate branches upward, the herbage pubescent throughout, with many hairs tipped by viscid glands. Leaves opposite at a few basal nodes, alternate at 4 to 6 upper ones, the sessile blade narrow-elliptic to oblong-lanceolate, not over 30 mm. long and 5 mm. broad, obscurely cuspidate. Inflorescence irregularly cymose, the branches tipped by 2- to 4-flowered cymules at uneven levels. Sepals 8–10 mm. long, united ⅜ to ½ their length, the membranes flat and blade with a terminal awn *ca.* 0.5 mm. long. Corolla-tube slender, 18–20 mm. long, glandular-pubescent. Petal-blade obovate, apiculate, 9–11 mm. long and 7–9 mm. broad, pink with pale eye. Styles 2–3 mm. long, united *ca.* half their length.

TYPE: Sandy soil along Route #380, 4 miles southwest of Jayton, Kent Co., Tex. (*ca.* latitude 33°13′ and longitude 100°37′),[1] *D. S. Correll & I. M. Johnston 22108*, May 18, 1959.

The only other collection known, which may be considered a co-type, is: Sandy oak-shinnery on dunes, O. H. Hamlin Ranch, 1½ miles southwest of Jayton, *C. L. Lundell 13046*, June 24, 1944. Both of these are in the herbarium of the Texas Research Foundation, but a fragment from the latter

[1] A reviewer of The Genus Phlox (1955) unwisely held that the giving of latitudes and longitudes of localities made them difficult to find. Actually, had only the range-township-section data of Land Office maps, or other merely local geographic designations been given, workers at a distance would have a hard time placing collection points, whereas atlases bearing coordinate lines are available to everyone, anywhere in the world. It may be pointed out, also, that the maps furnished in that book have each degree of latitude = 2.5 mm., and of longitude = 3.5 mm., so that any measurement given can readily be laid off by a mm. rule.

has been placed in the type herbarium of the Academy of Natural Sciences of Philadelphia.

The nearest relative of this taxon, both morphologically and geographically,[2] is t. *McAllisteri*, which may be considered a species, subspecies, or variety, as individually preferred. From it the new taxon differs strikingly in greater glandularity, shorter leaves and elongate corolla-tube. The relationship between them (as well as other annual taxa) deserves cytologic combined with detailed morphologic study.

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[2] Reaching a known northwestern limit west of Ballinger, at *ca.* 31°45′, and 100°.

TWO TEXAS-CHIHUAHUAN FERNS

Donovan S. Correll

I. A NEW ASPLENIUM FROM CHIHUAHUA

Asplenium Tryonii Correll, sp. nov. Fig. 36.

Herba parva; rhizoma compacta, erecta vel suberecta, squamata; frondes fasciculatae, arcuatae, patentes, rosulatae; stipites crassi, teretes, fibrillosi, rubro-brunnei, vernicosi; laminae lanceolatae, pinnatae, prope apicem viviparae; racheae rubro-brunneae, sparsim fibrillosae; pinnae 7–12 geminatae, triangulae vel triangulo-ovatae, obliquae, subcoriaceae, marginibus superioribus crenatibus; sori cuiusque pinnae 2–4; indusia magna et conspicua.

Plant small, with the arcuate fronds spreading on the mossy substratum; rhizome small, compact, erect to suberect, scaly; rhizome-scales lance-attenuate with a setaceous apex, dark brown, up to 3 mm. long; fronds closely fasciculate, 5–7 cm. long; stipes rather stout, dull reddish brown, shining, terete, fibrillose, up to about 1.5 cm. long; blades narrowly lanceolate, pinnate, when fresh bluish green in color, rooting at base of upper surface of terminal segment (viviparous) and sometimes from the upper surface of adjacent pinnae; rachis shallowly sulcate on upper surface, sparsely fibrillose, dull reddish brown up to or near the terminal segment; pinnae essentially opposite, mostly very shortly stalked, in 7 to 12 pairs, subcoriaceous, obliquely triangular to triangular-ovate, entire and truncate to broadly cuneate at base, coarsely crenate on the outer margin, up to about 5 mm. long, the veins obscure, the lowermost pinnae only slightly reduced, the uppermost pinnae few and distant; sori 2 to 4 to each pinna; indusia large and conspicuous, tan-color, glabrous, the margins somewhat erose-crenulate; sporangia silvery gray with a shiny brown annulus.

MEXICO: Chihuahua, in moss on shaded north-facing ledges, Tecolote, 10 miles west of Chinatú, 6,300 ft. alt., fronds bluish green, spreading flat on moss-mats, rooting near tips, indusia large, October 10, 1959, *D. S. Correll & H. S. Gentry 23000* (LL, type; GH, isotype); on moss-mat on ledge along stream below waterfall, about 3 miles south of La Rocha, Sierra Mohinora, 7,000 ft. alt., fronds rooting near tips, October 18, 1959, *Correll & Gentry 23213* (LL, cotype).

I am indebted to Dr. Rolla M. Tryon for his having provided me with a comparative analysis of this species and *A. castaneum* Schlechtd. & Cham. and *A. Palmeri* Maxon. He was of the opinion that the species under consideration was intermediate between *A. castaneum* and *A. Palmari* and was probably a hybrid derived from those species, although he did not rule out the possibility of the plant being a species new to science.

Fig. 36. *Marsilea mexicana* A. Br.: 1, habit, × 1; 2, modified branch supporting sporocarps, about × 4; 3, leaflet (note reddish lines), × 3. *Asplenium Tryonii* Correll: 4, habit, × 1; 5, apex of frond (note flagellate bud), ventral view, much enlarged; 6, pinna, × 9. Illustrated by Phoebejane Horning.

On the basis of my observations of the plant in the field and of several other factors, I have concluded that this plant is unique in several respects. It is a small, delicate plant with a rosette habit not unlike that of *A. vespertinum* Maxon, as it occurs in Chihuahua. When fresh, the blades are bluish green in color, and in the colonies that are found growing on dense mats of moss many of the plants are connected to one another because of the viviparous characteristic of the plant. Flagellate buds are not only formed dorsally at the base of the terminal segments but they also sometimes occur on the upper surface of adjacent pinnae. Among the Aspleniums in Chihuahua this viviparous characteristic is also known in the entirely different *A. Palmeri* and *A. exiguum* Bedd.

Asplenium castaneum, typically of central Mexico and southward, is not known to occur in Chihuahua, although it is found in Durango. Also, although, in 1959, Dr. H. S. Gentry and I made a thorough search for all species of ferns from Hidalgo de Parral to Guadalupe y Calvo and Sierra Mohinora, in southwest Chihuahua, no plants of *A. Palmeri* were found. The species is apparently quite rare, if not absent, in this part of the state. Because of the above facts, a hybrid origin for this plant does not seem likely.

It is a pleasure to name this species for Dr. Tryon, who has always been most gracious in helping his fellow-workers with their never-ending problems in the study of ferns.

I wish to acknowledge that the Chihuahua note is a part of the project on Ferns and Fern Allies of Chihuahua supported, in part, by a grant from the John Simon Guggenheim Memorial Foundation.

II. MARSILEA MEXICANA, NEW TO THE UNITED STATES (TEXAS)

In the course of studying the Marsileas of Chihuahua for a forthcoming work on the ferns and fern allies of Chihuahua with Dr. I. W. Knobloch, I incidentally identified some miscellaneous collections from Texas that had been accumulating in the Lundell Herbarium during the past few years. Among these was a collection of the distinctive *M. mexicana* A. Br., which is apparently new to the United States. The finding of this species in Texas now brings the total of pteridophytes known to occur in that state to 111.

MARSILEA MEXICANA A. Br., Monatsber. Ak. Berl. 747. 1870; Hemsley in Godman & Salvin, Biol. Centr.-Amer. 3: 710. 1883; Conzatti, Fl. Tax. Mex. 1(2): 156. 1936; Matuda, An. Inst. Biol. Mex. 27(1): 163. 1956. Fig. 36.

Zaluzianskya mexicana (A. Br.) O. Ktze., Rev. Gen. Pl. 2: 823. 1891.

Plants up to 20 cm. or more tall; rhizomes slender, widely creeping and much-branched, greenish brown to light brown; petioles filiform, channeled, glabrous, up to about 18 cm. long; nature leaflets 4, broadly cuneiform or obovate-flabellate, rounded and slightly undulate at apex, 1–1.5

cm. long, green, typically marked with reddish brown stripes (or glands?) parallel with the veins on the lower surface, glabrous or sometimes with a few hairs near base; peduncle (free part) approximately as long as the sporocarp or slightly longer, pubescent at first; sporocarps not scattered but densely clustered on special branchlets that also give rise to slender terete rigid rootlike structures, obovoid to ellipsoid, about 4 mm. long, somewhat compressed laterally, dark-colored, at first covered with matted light brown hairs and terminated with long dark brown hairs which are deciduous with age, the raphe and basal tooth obsolescent; sori approximately 12 or 13 in each sporocarp; microspores numerous.

TEXAS: Aransas County, growing on bottom of pond in pasture, 10 miles northeast of Rockport, leaves emergent, July 8, 1957, *D. S. Correll & I. M. Johnston 17623* (LL).

This species is distinctive in that at least some of its leaflets have reddish brown stripes, or possibly glands, on their lower surface parallel with the veins. Also, the sporocarps are borne in clusters on modified branchlets that also give rise to terete, rigid, rootlike structures that possibly might be considered as rhizophores.

Marsilea mexicana is now known to occur from Aransas County, Texas, and northern Mexico to Honduras. It is found in shallow water or on mud flats of pools and along streams and canals.

I wish to acknowledge that the Texas note is a part of the project on a MANUAL of the flora of Texas which is being supported by a grant (NSF-G15901) from the National Science Foundation, and which is to be prepared jointly with Dr. Marshall C. Johnston of The University of Texas.

A NEW SPECIES OF PSIDIUM FROM CHIAPAS

Cyrus Longworth Lundell

Psidium chiapasense Lundell, sp. nov.

Frutex, ramulis albido-tomentosis; folia chartacea, tomentosa, breviter petiolata, petiolo usque 2.5 mm longo; lamina obovato-elliptica, elliptica vel rotundata, 2.5–5 cm. longa, 1.7–3.3 cm. lata, apice rotundata et apiculata, basi rotundata; pedunculis usque 4 cm. longis, 1- vel 2-floris; calyce 4- vel 5-lobo, 4–5 mm. longo; petala ca. 1 cm. longa, ciliata.

Shrub, with exfoliating bark, the twigs usually short, white tomentose. Leaves chartaceous, white tomentose on both surfaces, subsessile, the petioles up to 2.5 mm. long; leaf blades drying grayish-black, obovate-elliptic, elliptic or suborbicular, 2.5 to 5 cm. long, 1.7 to 3.3 cm. wide, apex rounded and apiculate, base rounded, midvein elevated beneath, the lateral veins evident but inconspicuous on both surfaces. Peduncles slender, up to 4 cm. long, 1- or 2-flowered, solitary, axillary, tomentose. Calyx tomentose, 4 to 5 mm. long, open in bud, the lobes rounded or obtusish, splitting to base. Petals about 1 cm. long, ciliate, glabrous otherwise. Anthers oblong. Ovary white tomentose.

MEXICO: Chiapas, Trapichito, near Comitan, alt. 1350 m., June 2, 1945, *Eizi Matuda 5769* (type, LL), shrub.

In *P. chiapasense*, like *P. salutare* (H.B.K.) Berg, the calyx is open in bud. It differs from that species notably in being white tomentose, in having obovate to suborbicular leaves rounded and apiculate at apex, and in its 1- or 2-flowered peduncles.

PLANTAE MAYANAE—III

NOTABLE MYRTACEAE FROM PETEN AND BELICE

Cyrus Longworth Lundell

In continuation of the plant resources survey of Peten, as part of the "evaluation of the ancient agriculture of the lowland Maya area of Guatemala", supported by a grant from The Rockefeller Foundation, exploration was extended in 1960 from the Mexican border into south central Peten.

To make possible around the year investigations in order to obtain a representative collection of the flora, the American Philosophical Society, through its Penrose Fund, made a grant to support the 1961 field work of Elias Contreras. His collecting has implemented studies which I resumed in the Tikal National Park in February and March, 1961, from the base camp of the University of Pennsylvania Museum at Tikal.

Supplementing 1960 collections made in the Remate area at the eastern end of Lake Peten from the middle of March through June, and around Dos Lagunas near the Campeche boundary from October until the end of December, 1960, Elias Contreras has continued field work since March, 1961 in the savanna and rain forest areas of southeastern Peten, with headquarters at Dolores. His collecting, otherwise centered in the Tikal National Park, has contributed substantially to our knowledge of these areas.

As an illustration of the need for intensive exploration, the identification of the collections of Myrtaceae made in Peten since the project was inaugurated in 1959 has added one genus, *Myrciaria*, two species of *Calyptranthes*, a species of *Psidium*, and fourteen species of *Eugenia* to the known flora. Of particular interest is the new species, *Myrciaria Ibarrae* Lundell, which has large edible fruits, undoubtedly utilized by the ancient Maya.

Calyptranthes Contrerasii Lundell, sp. nov.

Arbor parva, ramulis glabris, bialatis; folia subcoriacea, ovata vel lanceolata, 3–7 cm. longa, 1.5–4 cm. lata, apice obtusa vel rotundata, basi cordata; inflorescentiae parvae; alabastra obovoidea, glabra, stipitata, apiculata, usque ad 3 mm. longa.

Small tree, 10 cm. diam., about 7 m. high; twigs glabrous, strongly compressed forming two sharp narrowly winged ridges. Leaves subsessile, subcoriaceous, paler beneath, the youngest with a few closely appressed reddish hairs on undersurface, glabrous early, the blades ovate or lanceolate, 3 to 7 cm. long, 1.5 to 4 cm. wide, apex obtuse or rounded, base cordate and clasping, costa elevated beneath, slightly impressed above, the lateral veins

obscure. Inflorescence shorter than the leaves, the peduncle and branches strongly compressed, glabrous except for a few short appressed reddish hairs. Flower buds obovoid, glabrous, apiculate, short stipitate, up to 3 mm. long, about 2.5 mm. wide at anthesis.

GUATEMALA: Department of Peten, Dolores, about 2 km. 500 m. south of the village, in high forest, May 20, 1961, *Elias Contreras 2360* (type, LL), small tree, 4 in. diam., 20 ft. high.

Related to *C. Bartlettii* Standl. and *C. Karlingii* Standl., the species differs notably from both in being glabrous and smaller in all parts, and from the latter in having ovate cordate leaves, obtuse or rounded at apex.

The collections by Elias Contreras include many interesting species, such as *C. Contrerasii*, and this species and *Eugenia Contrerasii* are named for him in recognition of his contribution to our knowledge of the Guatemalan flora.

Eugenia Contrerasii Lundell, sp. nov.

Arbor parva, ramulis puberulis; folia petiolata, petiolo puberulo 3–5 mm. longo; lamina chartacea, ovato-elliptica vel lanceolato-elliptica, 4–7 cm. longa, 1.5–3.5 cm. lata, apice obtuse acuminata, basi acuta vel cuneata; inflorescentia umbellata, dense puberula; pedicelli puberuli, (2–) 3–6 (–12) mm. longi; bracteola minuta, connata; sepala parva; petala glabra, oblongo-elliptica, 2.5–3 mm. longa; bacca globosa, 4–7 mm. diam.

Small slender tree, up to 10 m. high, twigs densely puberulent. Leaves chartaceous, petiolate, the petioles densely puberulent, slender, 3 to 5 mm. long, the blades yellow-green, puberulent along midvein above, otherwise glabrous, ovate-elliptic or lanceolate-elliptic, 4 to 7 cm. long, 1.5 to 3.5 cm. wide, apex acuminate, the acumen obtuse, base acute or cuneate, lateral veins inconspicuous. Inflorescence umbelliform, densely puberulent, the umbels 1 to 3 in the leaf axils, the rachis reduced, rarely 3 to 4 mm. long, the pedicels slender, puberulent, (2–) 3 to 6 (–12) mm. long. Bracteoles subtending ovary minute, connate, persistent, ciliate. Ovary obscurely puberulent, about 1 mm. long, constricted above, 2-celled, many ovulate. Sepals minute, puberulent, unequal, depressed ovate and rounded, the smaller pair about 0.5 mm. long, the larger pair about 0.7 mm. long, persistent, crowning the fruits. Petals white, glabrous, oblong-elliptic, 2.5 to 3 mm. long. Fruits black at maturity, globose, 4 to 7 mm. in diam. Embryo homogeneous.

GUATEMALA: Department of Peten, Tikal National Park, Tikal, bordering Aguada Bejucal, February 27, 1960, *C. L. Lundell 16597* (type, LL), characteristic small slender tree of *aguada* border forest, up to 15 ft. high; Tikal, on Arroyo Corriental, about 400 m. below Aguada Naranjal, Jan. 31, 1961, *Elias Contreras 1907* (LL), tree, 3 in. diam., 25 ft. high, flowers white, "*chilonche*"; Dolores, 2 km. 450 m. south of the village, bordering *pinal* and high forest, May 20, 1961, *Contreras 2364* (LL), tree, 5 in. diam., 30 ft. high, fruits black, "*chilonche*".

The umbelliform inflorescence, minute and connate bracteoles, densely puberulent twigs and inflorescences, puberulent ovary constricted above, and small calyx well mark the species. Collections from British Honduras have been referred to *E. Capuli* (Schlecht. & Cham.) Berg of Veracruz, to which *C. Contrerasii* apparently has very close affinity.

The new species is represented by numerous collections from Peten and southern British Honduras. In Peten it is a characteristic element of the forest growing around water holes (*aguadas*) and in other swampy areas.

Eugenia dissitiflora Lundell, sp. nov.

Arbor parva, ramulis puberulis; folia subcoriacea, novella parce sericea, glabrata, petiolata, petiolo puberulo, 4–7 mm. longo; lamina oblonga vel lanceolata, 4–9.5 cm. longa, 1.5–4 cm. lata, apice obtusa vel obtuse acuminata, basi acuta vel rotundata et acutiuscula; inflorescentia racemosa, puberula; pedicelli puberuli, 2–5 mm. longi; bracteola minuta; ovarium glabrum; sepala parva, late ovata, 0.5–0.8 mm. longa, ciliata.

Small tree, 7.5 cm. diam., 8 m. high, twigs slender, puberulent at first, glabrate, drying grayish. Leaves subcoriaceous, pale green, the leaf buds and young leaves sparsely sericeous, the mature leaves glabrous, petiolate, the petioles 4 to 7 mm. long, finely puberulent at first; leaf blades oblong or lanceolate, 4 to 9.5 cm. long, 1.5 to 4 cm. wide, apex obtuse or acuminate, the acumen obtuse, base acute or rounded and acutish, midvein impressed above, elevated beneath, lateral veins usually 7 to 9, obscure above, inconspicuous beneath. Inflorescence racemiform, puberulent, the rachis often greatly reduced, sometimes up to 1 cm. long, the racemes 1 to 3 in the leaf axils. Pedicels puberulent, 2 to 5 mm. long. Bracteoles minute, persistent. Ovary glabrous. Sepals depressed ovate, 0.5 to 0.8 mm. long, obtuse rounded, ciliate, incurved and persistent on young fruits.

GUATEMALA: Department of Peten, Santo Toribio, in *tintal*, July 27, 1961, *Elias Contreras 2684* (type, LL), small tree, 3 in. diam., 20 ft. high, fruits green, "*guayabillo*"; same locality and date, in *tintal*, *Contreras 2686* (LL), small tree, 3 in. diam., 25 ft. high, fruits green.

The material is incomplete, but the relationship of *E. dissitiflora* appears to be with *E. Bartlettiana* Lundell.

Eugenia guttata Lundell, sp. nov.

Arbor parva, ramulis glabris; folia subcoriacea, glabra, petiolata, petiolo 5–8 mm. longo; lamina lanceolata vel lanceolato-elliptica, 3–7.5 cm. longa, 1–3.3 cm. lata, apice subacuminata, obtusa, basi acuta vel acutiuscula; inflorescentia racemosa, glabra; pedicelli 1–1.8 mm. longi; bracteola parva; sepala parva, 0.2–0.4 mm. longa, apice truncata vel late rotundata; petala ciliata, usque 2.5 mm. longa; bacca globosa, rubra, 8–10 mm. diam.

Small tree, up to 7.5 cm. diam., 7 m. high, buds in axils of leaves with a few appressed hairs, glabrous otherwise, twigs with short internodes. Leaves

entirely glabrous, concolorous, drying mottled-gray, subcoriaceous, petiolate, the petioles 5 to 8 mm. long; leaf blades lanceolate or lanceolate-elliptic, 3 to 7.5 cm. long, 1 to 3.3 cm. wide, obtuse, usually subacuminate, base acute or acutish, midvein impressed above, prominent beneath, the lateral veins evident but inconspicuous on both surfaces. Inflorescence racemiform, congested, usually shorter than the petioles, glabrous except for the ciliate bracts and bracteoles, the rachis less than 3 mm. long. Pedicels very short, 1 to 1.8 mm. long, not accrescent. Bracteoles minute, usually connate at base, persistent. Ovary glabrous, 2-celled, many ovulate. Sepals minute, ciliate, unequal, apex subtruncate or broadly rounded, 0.2 to 0.4 mm. long. Petals ciliate, up to 2.5 mm. long. Fruits depressed globose, 8 to 10 mm. in diam. Embryo homogeneous.

GUATEMALA: Department of Peten, Tikal National Park, in secondary swamp forest, on *pinal* trail, July 24, 1959, *Elias Contreras 25* (type, LL), tree, 2 in. diam., 12 ft. high, flowers white; Tikal, Bajo de Santa Fe, Aguada Puete, Oct. 28, 1959, *Contreras 338* (LL), tree, 3 in. diam., 20 ft. high, fruits reddish.

The mottled-gray leaves, congested small racemiform inflorescences shorter than petioles, pedicels less than 2 mm. long, and unique minute sepals truncate at apex are distinguishing characteristics of the species.

EUGENIA KOEPPERI Standl., in Yuncker, Publ. Field Mus. Bot. 9: 320. 1940.

GUATEMALA: Department of Peten, Dolores, about 2 km. south of village, in high forest, July 18, 1961, *Elias Contreras 2628* (LL), small tree, 4 in. diam., 20 ft. high.

Described from Honduras, the species is new to Guatemala.

EUGENIA LEPTOPA Lundell, Bull. Torrey Club 69: 396. 1942.

GUATEMALA: Department of Peten, Remate, about 12 km. west of the village, in high forest bordering Lake Peten, May 23, 1960, *Elias Contreras 985* (LL), tree, 2 in. diam., 5 ft. high, "*chilonche*".

Described from Yucatan, this species has not been reported previously from Guatemala.

EUGENIA MAYANA Standl., Contr. U. S. Nat. Herb. 23: 1042. 1924.

GUATEMALA: Department of Peten, Tikal National Park, Aguada San Geronimo, north of *pinal* trail, Aug. 8, 1960, *Elias Contreras 1399* (LL), tree, 5 in. diam., 40 ft. high, fruits yellow-green.

A common species of Yucatan, this is the first record for Peten. The leaves of the Guatemalan collection are atypically large.

EUGENIA PETENENSIS Lundell, Bull. Torrey Club 69: 397–398. 1942.

Eugenia eutenuipes Lundell, Wrightia 2: 106. 1960.

GUATEMALA: Department of Peten, Dolores, on old Machaquila Road, about 800 m. south of village, in low forest of *pinal*, May 18, 1961, *Elias Contreras 2337* (LL), small tree, 1 in. diam., 3 ft. high, fruits violet-blue, "*chilonche macho*"; same locality and date, *Contreras 2347* (LL), small tree, 2 in. diam., 5 ft. high, fruits black-violet; same locality and date, *Contreras 2348* (LL), small tree, 1 in. diam., 5 ft. high, fruits black-violet, "*chilonche*"; same locality, May 28, 1961, *Contreras 2218* (LL), arborescent shrub, 1 in. diam., 3 ft. high, fruits purple-black, "*guayabillo*".

With ample material of *E. petenensis* now available from Peten, it is evident that *E. eutenuipes*, described from Chiapas, is synonymous.

Eugenia rufidula Lundell, sp. nov.

Arbor parva, 7.5 cm. diam., ramulis novellis rufo-pilosis; folia novella rufo-pilosa, chartacea, petiolata, petiolo ca. 2 mm. longo; lamina lanceolata, 2.5–5 cm. longa, 0.8–1.5 cm. lata, apice obtuse acuminata, basi acuta; flores racemosi; pedicelli 1.5–2 mm. longi; bracteola parva; sepala 0.8–1.3 mm. longa, ciliata; bacca subglobosa, ca. 6 mm. diam.

Small tree, 7.5 cm. in diam., twigs slender, at first densely pilose with reddish hairs, the persistent shorter hairs incurved on older growth. Leaves soft pilose on both surfaces at first with reddish hairs, glabrate except along the midvein, chartaceous, drying reddish-black above, paler beneath, short petiolate, the petioles about 2 mm. long, the leaf blades lanceolate, 2.5 to 5 cm. long, 0.8 to 1.5 cm. wide, apex obtusely acuminate, base acute, midvein elevated beneath, plane above, lateral veins inconspicuous. Inflorescence racemiform, pubescent, the rachis up to 6 mm. long, the racemes usually two in each leaf axil, congested, conspicuously bracteate. Pedicels short, 1.5 to 2 mm. long. Bracteoles free, ovate, small, persistent. Young immature fruits globose, glabrous, crowned by the persistent calyx, the sepals erect, incurved, unequal, depressed ovate, rounded, 0.8 to 1.3 mm. long, ciliate. Mature fruit about 6 mm. in diam. Embryo subglobose, about 3 mm. in diam., homogeneous.

BRITISH HONDURAS: Toledo District, Edwards Road beyond Columbia, in high ridge on bank of creek, Feb. 4, 1948, *Percy H. Gentle 6385* (LL), tree, 3 in. diam., "*cacho de venado*", "*small leaf turtle bone*".

Although superficially resembling *E. vacana* Lundell, especially in pubescence and leaf form, *E. rufidula* may be readily distinguished by its racemiform congested inflorescences and short pedicels. Also, the petioles are somewhat shorter than in *E. vacana*.

Eugenia Shookii Lundell, sp. nov.

Arbor 13-metralis, ramulis rufo-sericeis; folia novella sericea, glabrata, chartacea, petiolata, petiolo 5–7 mm. longo; lamina oblongo-elliptica vel lanceolato-elliptica, 5–8 cm. longa, 2.3–3.3 cm. lata, apice subabrupte acuminata, basi acuta; inflorescentia parva, rufo-sericea, racemosa; pedicelli

1.5–3.5 mm. longi; bracteola lineari-lanceolata; sepala inaequalia, 1–2 mm. longa, rufo-sericea; bacca oblonga.

Tree, up to 20 cm. in diam., 13 m. high, twigs slender, densely sericeous with reddish-brown hairs. Leaves sericeous at first, glabrate early, yellow-green, paler beneath, chartaceous, petiolate; the petioles slender, canaliculate, red-sericeous, 5 to 7 mm. long; the leaf blades oblong, elliptic or lanceolate-elliptic, 5 to 8 cm. long, 2.3 to 3.3 cm. wide, apex subabruptly acuminate, base acute, midvein impressed above, elevated beneath, the lateral veins inconspicuous. Inflorescence racemiform, densely sericeous with reddish-brown hairs, the rachis short, usually shorter than the petioles. Pedicels short, 1.5 to 3.5 mm. long, not accrescent. Bracteoles linear-lanceolate, free, up to 1 mm. long, pubescent. Ovary and calyx sericeous with reddish-brown hairs. Sepals unequal, the smaller pair triangular, 1 to 1.5 mm. long, the larger pair ovate and rounded, 2 mm. long. Petals glabrous, 2.2 to 2.5 mm. long. Ovary elongated, 2-celled, many ovulate. Fruits (immature) oblong, 1 cm. long, about 6 mm. in diam., crowned by the persistent calyx.

GUATEMALA: Department of Peten, Dolores, about 2 km. south of the village, bordering high forest and *pinal*, July 18, 1961, *Elias Contreras 2329* (type, LL), small tree, 6 in. diam., 25 ft. high, "*guayabillo*"; Dolores, km. 85, west of the Machaquila Road, in high forest, July 22, 1961, *Contreras 2647* (LL), tree, 8 in. diam., 40 ft. high, "*guayabillo*".

Although it superfically resembles *E. Fadyenii* Krug & Urban, *E. Shookii* is to be recognized by its smaller dark green acuminate leaves, inflorescences with rachis shorter than the petioles, pedicels usually less than 3 mm. long, and much smaller flowers. The oblong fruits indicate the relationship.

I take pleasure in naming this distinctive species for Edwin M. Shook, Director of the Tikal Project of the University of Pennsylvania Museum.

Eugenia tikalana Lundell, sp. nov.

Arbor parva, ramulis puberulis; folia petiolata, petiolo puberulo, 2.5–3 mm. longo; lamina membranacea, lanceolato-elliptica vel ovato-elliptica, 4–6 cm. longa, 1.5–2.8 cm. lata, basi acuta, apice obtuse acuminata; inflorescentia racemosa, dense puberula; pedicelli 1–5 mm. longi; bracteola parva; sepala inaequalia, rotundata, 1–1.5 mm. longa; petala ca. 3 mm. longa; bacca globosa, 8–12 mm. diam.

Small understory tree, up to 25 cm. in diam., 12 m. high, twigs reddish-brown, slender, densely puberulent, the minute hairs often incurved. Leaves yellow-green, slightly paler beneath, membranaceous, petiolate, the petioles puberulent, slender, 2.5 to 3 mm. long, the leaf blades lanceolate-elliptic or ovate-elliptic, 4 to 6 cm. long, 1.5 to 2.8 cm. wide, base acute, apex acuminate, the acumen obtusish, persistently puberulent along the midvein above, otherwise glabrate early, the lateral veins slender and inconspicuous. Inflorescence racemiform, densely and persistently puberulent, the

racemes 1 to 3 in the leaf axils, the rachis (1–) 3 to 8 (–20) mm. long, pedicels 1 to 5 mm. long, stout in fruit. The bracteoles subtending ovary minute, distinct, remote, persistent in fruit. Flowers white, the buds up to 2.5 mm. in diam. Sepals minutely puberulent, ciliate, unequal, rounded, the smaller pair about 1 mm. long, the larger pair about 1.5 mm. long, persistent and incurved in fruit, forming a small crown. Petals about 3 mm. long, suborbicular, ciliate. Style 4.5 to 5 mm. long. Ovary 2-celled, many-ovulate. Berry globose, crowned by the small calyx, orange-red at first, becoming purple-black when ripe and 8 to 12 mm. in diam., with thin juicy pericarp, 1-seeded. Embryo homogeneous.

GUATEMALA: Department of Peten, Tikal National Park, Tikal, in *ramonal*, May 8, 1959, *C. L. Lundell 15971* (type, LL), tree, 9 in. diam., 37 ft. high, flowers white; same locality, beyond Temple of the Inscriptions, in *ramonal*, March 4, 1961, *Lundell 16857* (LL), slender tree, 2 in. diam., 15 ft. high, fruits orange-red at first, purple-black at maturity; same locality, on Remate Road, in *zapotal*, Feb. 25, 1961, *Elias Contreras 2000* (LL), tree, 5 in. diam., 30 ft. high, fruits purple-black, "*guayabillo*".

The densely puberulent twigs and inflorescences, mostly elongated racemes with comparatively short pedicels, minute bracteoles, and large fruits serve to distinguish *E. tikalana*. It appears to be related to *E. xalapensis* (H.B.K.) DC. of Veracruz.

E. tikalana has been collected repeatedly in northern Peten from Remate north to Dos Lagunas, where it is a conspicuous small tree of the upland forest, *ramonal* and *zapotal*.

Eugenia Trikii Lundell, sp. nov.

Arbor parva, albido-strigillosa, ramulis glandulo-puberulis; folia chartacea, pallida, petiolata, petiolo 5–7 mm. longo; lamina ovato-elliptica vel elliptica, 6–11.5 cm. longa, 2.5–6 cm. lata, basi rotundata, apice obtuse acuminata; inflorescentia umbellata, albido-strigillosa; pedicelli fructiferi usque ad 7 mm. longi; bracteola ciliata, glabra; ovarium albido-strigillosum; sepala glabra, ciliata, 1–1.4 mm. longa; petala glabra; bacca globosa, usque ad 1.5 cm. diam.

Small tree, up to 7.5 cm. in diam., 8 m. high, twigs reddish-brown, slender, strigillose at first, persistently and minutely puberulent, the hairs usually gland-tipped. Leaves chartaceous, drying grayish and pallid, petiolate, the petioles canaliculate, 5 to 7 mm. long, sericeous at first, the leaf blades ovate-elliptic or elliptic, 6 to 11.5 cm. long, 2.5 to 6 cm. wide, base rounded, apex subabruptly acuminate, the acumen obtuse, persistently but rather sparsely sericeous on undersurface, midvein prominent beneath, the lateral veins evident but inconspicuous. Inflorescence umbelliform, the short rachis and pedicels densely sericeous with white hairs. Pedicels up to 7 mm. long (in fruit). Bracteoles free, ciliate but otherwise glabrous, ovate, up to 1 mm. long, persistent. Ovary conspicuously white sericeous. Sepals ciliate, otherwise glabrous outside and inside, subequal, depressed ovate, 1 to 1.4

mm. long, not accrescent in fruit. Petals glabrous. Fruits purple, 1- or 2-seeded, globose, up to 1.5 cm. in diam. Embryo homogeneous.

GUATEMALA: Department of Peten, 2 km. south of Santa Elena, on top of hill, in *chechemal*, March 28, 1961, *Elias Contreras 2057* (type, LL), arborescent shrub, 1 in. diam., 5 ft. high; Tikal National Park, Tikal, in *ramonal*, April 30, 1959, *C. L. Lundell 15932* (LL), tree, 3 in. diam., 25 ft. high, fruits purple.

E. Trikii is closely related to *E. yucatanensis* Standl., but differs in its more elliptic pallid leaves, glandular-puberulent twigs, strigillose rather than silky sericeous pubescence of undersurface of leaf, and in having glabrous bracteoles and sepals. The sepals are subequal, the larger not over 1.4 mm. long in fruit. In *E. yucatanensis* the sepals are persistently strigillose on inner surface, and the larger are up to 3.5 mm. long. In *E. Trikii* the sepals crowning the fruits are incurved and almost flat, whereas they are spreading in *E. yucatanensis* (see *C. L. Lundell & Amelia A. Lundell 7625* from Coba, Quintana Roo).

The species is named for Aubrey Trik, Assistant Director for Restorations and Administration, the Tikal Project of the University of Pennsylvania Museum, as a token of appreciation for his assistance with the botanical field work at Tikal in 1959 and 1960.

Eugenia vesca Lundell, sp. nov.

Frutex 1-metralis, ramulis glabris; folia glabra, membranacea, petiolata, petiolo 4–5 mm. longo; lamina lanceolata vel lanceolato-oblonga, 6–9 cm. longa, 2.5–3.7 cm. lata, apice subacuminata, obtusa, basi acuta; flores in axillis aggregati fasciculati, pedicellis nullis; bracteola ca. 1 mm. longa; sepala ciliata, 0.7–1.2 mm. longa, late ovata, apice rotundata; bacca rubra, globosa, 5–7 mm. diam.

Shrub, 1 mm. high, twigs slender, with exfoliating reddish bark, with a few reddish hairs on buds in leaf axils, the mature leaves and older growth glabrous. Leaves membranaceous, glabrous, dark green above, somewhat paler beneath, petiolate, the petioles slender, 4 to 5 mm. long; leaf blades lanceolate or lanceolate-oblong, 6 to 9 cm. long, 2.5 to 3.7 cm. wide, apex obtuse, base acute, the midvein slightly impressed above, elevated beneath, the lateral veins evident on both surfaces, but inconspicuous. Fruits sessile or subsessile in the leaf axils. Bracteoles persistent, about 1 mm. long. Berry dark red, globose, 5 to 7 mm. in diam., crowned by the ciliate unequal sepals, the persistent sepals depressed ovate, 0.7 to 1.2 mm. long, rounded. Embryo homogeneous, subglobose, about 4.5 mm in diam.

GUATEMALA: Department of Peten, Dolores, bordering arroyo, south of village, in high forest, April 14, 1961, *Elias Contreras 2080* (type, LL), shrub, 3 ft. high, fruits red.

E. vesca is related to *E. patalensis* Standl. & Steyerm., but that species is described as having rigidly coriaceous leaves with petioles 7 to 10 mm. long.

EUGENIA YUCATANENSIS Standl., Publ. Field Mus. Bot. 8: 28. 1930.

GUATEMALA: Department of Peten, Dolores, bordering Arroyo Mul, in low forest, July 13, 1961, *Elias Contreras 2592* (LL), small tree, 2 in. diam., 12 ft. high, flowers white.

This is the first record for the species in Peten.

Myrciaria Ibarrae Lundell, sp. nov.

Arbor parva, ramulis puberulis; folia petiolata, petiolo puberulo, usque ad 5 mm. longo; lamina chartacea, lanceolata vel oblongo-lanceolata, 3–8.5 cm. longa, 1.5–3.3 cm. lata, apice acuminata, basi rotundata et acutiuscula; bracteola imbricata, ciliata; flores sessiles; fructus globosus, usque ad 2.5 cm. diam.

Small tree, 10 cm. diam., 10 m. high; twigs densely foliate, conspicuously puberulous. Leaves chartaceous, grayish-green, costa elevated beneath and bearing a few hairs, puberulous above, lateral veins numerous but obscure, the blades lanceolate or oblong-lanceolate, 3 to 8.5 cm. long, 1.5 to 3.3 cm. wide, base rounded, usually acutish, apex acuminate; petioles puberulous, up to 5 mm. long. Flowers white, glomerate, strictly sessile. Bracteoles fleshy, white, imbricate, 1 mm. long, ciliate, otherwise glabrous. Receptacle glabrous, fleshy, 2 to 3 mm. long, at last circumscissile above the ovary. Sepals 4, imbricate, ciliate, deciduous with the receptacle. Petals ovate, 2 mm. long, ciliate. Ovary puberulous at base of style, glabrous outside. Berry sessile, globose, 1- or 2-seeded, up to 2.5 cm. diam., seeds up to 1 cm. diam. Embryo homogeneous.

GUATEMALA: Department of Peten, Dos Lagunas, on Ixcanrio Road, about 3 km. 500 m. ne. of the village, in low forest, Nov. 24, 1960, *Elias Contreras 1645* (type, LL), tree, 4 in. diam., 30 ft. high, flowers white, "*guayabillo*"; same locality, in *zapotal*, Oct. 11, 1960, *Contreras 1512* (LL), tree, 3 in. diam., 25 ft. high, "*guayabillo*"; same locality, on Uaxactun trail, about 4 km. sw. of the village, in *zapotal*, Oct. 26, 1960, *Contreras 1562* (LL), tree, 3 in. diam., 30 ft. high, "*guayabillo*"; same locality, about 3 km. east of the village, in low forest, Dec. 26, 1960, *Contreras 1748* (LL), tree, 4 in. diam., 30 ft. high, flowers white, "*guayabillo*"; same locality and date, *Contreras 1749* (LL), tree, 3 in. diam., 20 ft. high, flowers white, "*guayabillo*".

M. Ibarrae, named for Sr. Jorge A. Ibarra, Director of the Museo Nacional de Historia Natural of Guatemala, is noteworthy for its strictly sessile flowers and fruits subtended by imbricate fleshy bracteoles. Closely related to *M. floribunda* (West, ex Willd.) Berg, it is distinguished further by its larger fruits and larger grayish leaves with blades mostly rounded at base. In *M. floribunda* the minute subtending bracteoles are connate, and the pedicels are up to 1 mm. long.

Myrcia belizensis Lundell, sp. nov.

Frutex scandens, ramulis novellis sericeis; folia chartacea, novella parce sericea, petiolata, petiolo 5–9 mm. longo; lamina lanceolata, 5–10.5 cm.

longa, 1.5–3.3 cm. lata, apice subabrupte acuminata, acumine obtusa, basi acuta; inflorescentia paniculata, parce sericea; pedicelli usque 3 mm. longi; bracteola decidua; ovarium sericeum; sepala marginata, ca. 1 mm. longa, acutiuscula; petala 2–2.5 mm. longa; bacca elliptico-oblonga, ca. 1 cm. longa.

Woody vine, stems slender and elongated, the twigs subterete, compressed at the nodes, sericeous at first, glabrate early. Leaves chartaceous, sparsely sericeous on undersurface at first, glabrous above except along the midvein, entirely glabrous at maturity except along the puberulous midvein above, long petiolate, the petioles slender, 5 to 9 mm. long, sericeous at first; leaf blades concolorous, lanceolate, 5 to 10.5 cm. long, 1.5 to 3.3 cm. wide, apex subabruptly acuminate, the long slender acumen obtusish, base acute, midvein impressed above, prominent beneath, the numerous slender parallel veins evident on both surfaces, reticulate. Panicles long pedunculate, usually equalling the leaves, sparsely short sericeous, nearly glabrous, many-flowered. Pedicels short, rarely up to 3 mm. long, the terminal flower sessile. Bracts and bracteoles deciduous early. Flowers white, the ovary densely white sericeous, about 1.2 mm. high. Sepals depressed ovate, subequal, marginate, about 1 mm. long, acutish, sparsely appressed puberulous, ciliolate. Torus finely pubescent. Petals suborbicular, 2 to 2.5 mm. long, sparsely appressed puberulous outside, ciliolate. Berry elliptic-oblong, about 1 cm. long, crowned by the erect persistent calyx. Embryo contort-plicate.

BRITISH HONDURAS: Toledo District, in *acahual* near San Antonio, July 15, 1948, *Percy H. Gentle 6571* (type, LL), woody vine, flowers white; beyond San Antonio, in *acahual*, August 7, 1948, *Gentle 6584* (LL), woody vine.

M. belizensis is a woody vine, exceptional in this genus, and it is noteworthy further for its long petioles, fully twice the length of those of *M. rufidula* Schlecht., *M. Oerstediana* Berg, and *M. Schippii* Lundell, the related species.

Gentle, noting that this was a lianoid species, rather than a tree, collected twenty specimens of each number, all superb material!

Myrcia Gentlei Lundell, sp. nov.

Arbor parva, ramulis novellis rufo-strigosis; folia coriacea, glabra, petiolata, petiolo 2–3 mm. longo; lamina lanceolata, 6–13 cm. longa, 1.8–4.5 cm. lata, apice subacuminata, acumine obtusa, basi acuta vel rotundata; inflorescentia paniculata, parce rufo-puberula; pedicelli usque 2 mm. longi; bracteola decidua; ovarium glabrum; sepala ovata vel rotundata, 1–1.5 mm. longa; petala 3–5, ca. 2 mm. longa; bacca globosa, 7–10 mm. lata.

Tree, up to 25 cm. diam., usually with rather stout short twigs, the bark exfoliating early, the young growth evidently red strigose. Leaves coriaceous, glabrous at maturity, concolorous, short petiolate, the petioles stout, 2 to 3 mm. long; leaf blades lanceolate, 6 to 13 cm. long, 1.8 to 4.5 cm. wide,

apex obtusely subacuminate or sometimes obtuse, base acutish, sometimes rounded, midvein impressed above, elevated beneath, the lateral veins evident but obscure on both surfaces. Panicles much-branched, sometimes exceeding the leaves, puberulous with reddish hairs, many-flowered. Bracts and bracteoles deciduous early. Flowers white, sessile or subsessile, the pedicels rarely exceeding 2 mm. Ovary glabrous. Sepals very unequal, depressed ovate or broadly rounded, the smaller about 1 mm. long, acutish, the larger petaloid, about 1.5 mm. long, rounded, puberulous with short red appressed hairs, strongly reflexed. Petals sometimes reduced to 3, suborbicular, about 2 mm. long, with a few short appressed red hairs on outer surface. Torus glabrous. Berry subglobose, 1- or 2-seeded, glabrous, 7 to 10 mm. diam., crowned by persistent calyx. Embryo contort-plicate.

BRITISH HONDURAS: Toledo District, between Rancho Chico and Cockscomb, in wild coffee ridge, April 1, 1943, *Percy H. Gentle 4378* (type, LL), tree, 7 in. diam., flowers white, "*parrot plum*".

The coriaceous leaves, glabrous ovary and torus, and subglobose berries are characteristics by which the species may be easily recognized. Of significance is the presence of petaloid sepals and a corresponding reduction of the petals to three in some flowers. All other species of *Myrcia* in the area have elongated rather than depressed globose fruits.

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AN INVESTIGATION OF TEMPLE PLASTERS FROM TIKAL, GUATEMALA, WITH EVIDENCE OF THE USE BY THE ANCIENT MAYA OF PLANT EXTRACTS IN PLASTER MAKING

W. DERBY LAWS

The samples used in this investigation were obtained from Tikal by Dr. C. L. Lundell in July, 1959. There were two samples of limestone material, the hard rock which tops the area and the soft material which underlays the hard rock. Four samples of plaster or mortar from the temples of Tikal were also obtained. The samples were ground to pass a 60-mesh sieve before the analytical work was started. The soft material was separated into three fractions: that which passed a 100-mesh sieve without grinding, that retained on a 100-mesh sieve but passing a 1-mm. sieve, and that which would not pass a 1-mm. sieve and required grinding. Each sample was assigned a laboratory number for ease of identification during the analysis. The location from which each sample was obtained, a description of the sample, and the assigned laboratory number are shown in Table 18.

PROCEDURES AND RESULTS

Samples of the rocks and plasters were treated with sufficient concentrated hydrochloric acid to neutralize the calcium carbonate present and were then washed with 0.1 N hydrochloric acid until free of calcium as shown by testing the supernatant liquid with sodium oxalate. The acid insoluble residue was then washed through a 300-mesh sieve to remove materials normally classed as sand.

It was found that each plaster sample left a residue of organic fibers on the sieve. All were black except those from the interior wall plaster (sample A-10)[1] which were white, or very light tan. The per cent of the total sample present as fibers was small. The interior wall plaster (A-10) was 0.059% white fibers; the exterior plaster (A-8) 0.056% black fibers; the floor plaster (A-9) 0.008% black fibers; and the mortar (A-11) 0.018% brown fibers. These values are based upon the oven dry (105°C) weight of material removed from the sand fraction by screening through a 60-mesh sieve.

[1] This sample of wall plaster was pure white with no evidence of ever having been covered with mildew. It was observed that, after the plaster was ground, addition of water produced a very distinctive odor. The same odor, but much stronger was noted when a sample was autoclaved. This observation leads to the interesting possibility that some plant extract or other substance may have been added to make the wall plaster immune to mildew. This point would seem to merit additional investigation.

Table 18

DESCRIPTION OF THE PLASTER, LIMESTONE, AND CLAY SAMPLES FROM TIKAL

Lab. No.	Location and Description of Samples
A-1	Surface 8 inches of hard rock over the *sac cab*. From Sawmill Quarry.
A-2	Soft rock, *sac cab*, from 6 feet depth in the Sawmill Quarry. The material which passed a 100-mesh sieve without grinding. This was 68.2% of the total material in the sample collected by Dr. Lundell.
A-2a	Material from the sample of soft rock, *sac cab*, which was retained on a 1-mm. sieve. It was ground to pass a 60-mesh sieve before use in the analysis. This material constituted 24.3% of the sample (A-2) collected by Dr. Lundell. The remaining 7.5% passed a 1-mm. sieve but was retained on a 100-mesh sieve and was not studied.
A-3	A ball of pinkish-purplish clay about 8 cm. in diameter with green mottling along one side. It broke into fragments upon drying for 24 hours at 50°C. The green portion was separated from sample before grinding for analysis. No clear-cut separation was possible. (Bag 5 Sample, Lundell 5, Clay (?) included in marl below bed rock.)
A-5	Tikal, Bajo de Santa Fe. Clay from depth below 12 feet. Pit in *tintal*. Two bags composited to get this sample.
A-7	Lime burned in July, 1959 from kiln at Tikal. Made from the hard limestone (Sample A-1) which tops the *sac cab*.
A-8	Sample of exterior plaster from north and south sides of Stairway No. 1, Temple I. (July 17, 1959. Sample, Lundell 1.)
A-9	Sample of floor material. Floor B in Tunnel 5, east of Cache 48, Temple I. (July 17, 1959. Sample, Lundell 2.)
A-10	Sample of interior plaster from the walls of rooms A-B-C in Temple I. (July 17, 1959. Sample, Lundell 3.)
A-11	Sample of masonry mortar from vault over room A, Temple II. (July 17, 1959. Sample, Lundell 4.)

Examination under a microscope showed that the fibers had small mineral particles clinging to them, but the greater portion of the material was plant fibers of some kind. In addition there were some fibers which passed the 60-mesh sieve when the dry sand fraction was sieved and these would help compensate for the mineral fragments clinging to the weighed fibers. Note the per cent of the total classed as sand and the per cent silica in the sand fraction (Table 19). The difference is largely organic material.

The residue remaining after removal of the sand was dried and the weight added to the weight of sand to give the total insoluble residue (Table 19). The dried acid insoluble residues of the various rocks and plasters were different colors. The hard rock gave a residue of dark brown to black color, the *sac cab* a brownish color, exterior wall plaster a dark brown, floor material residue was black, A-10 interior wall plaster a light tan, and the mortar a black residue.

Table 19

SOME PHYSICAL PROPERTIES OF TEMPLE PLASTERS, NATIVE LIMESTONES, AND ASSOCIATED CLAY MATERIALS FROM TIKAL

Lab. No.	Sample Type	Insoluble Residue	Sand Fraction		Ignition Loss	
			Total	Silica	100–600	600–1000
		%	%	%	%	%
A-1	Rock	1.48 ± .05	.093 ± .011	.080	1.7	42.3
A-2	*Sac cab* (marl)	1.23 ± .03	.006 ± .001	.004	0.7	42.8
A-2a	*Sac cab* (marl)	7.12 ± .04	.070 ± .001	—	—	—
A-3	Clay Ball	97.71 ± .06	.850 ± .540	—	8.2	3.6
A-7	Lime	0.74 ± .09	.288 ± .094	.206	0.0	36.8
A-8	Exterior	2.41 ± .07	.130 ± .015	.066	4.8	39.5
A-9	Floor	2.76 ± .03	.054 ± .002	.035	2.3	41.4
A-10	Wall	2.51 ± .16	.094 ± .014	.041	5.2	39.0
A-11	Mortar	3.43 ± .05	.082 ± .003	.048	3.8	39.9
A-5	*Tintal*	98.31 ± .00	.400 ± .030	—	8.2	3.9

Table 20

NITROGEN, ORGANIC MATTER AND WATER SOLUBLE CATIONS OF PLASTERS, LIMESTONES, AND CLAY MATERIALS

Lab. No.	Sample Type	Water Soluble			Organic Matter	Nitrogen
		Calcium	Potassium	Sodium		
		PPM	*PPM*	*PPM*	%	%
A-1	Rock	250	25	32	0.35	.013
A-2	*Sac cab* (marl)	170	12	28	0.05	.001
A-2a	*Sac cab* (marl)	285	18	32	0.14	—
A-3	Clay Ball	260	6	33	0.12	.003
A-8	Exterior	10,125	231	1550	1.00	.077
A-9	Floor	1,010	48	194	0.47	.028
A-10	Wall	2,860	232	410	0.63	.122
A-11	Mortar	3,730	59	500	0.47	.034
A-5	*Tintal*	2,690	52	400	0.12	.007

The plaster samples were analyzed for water soluble sodium, potassium, and calcium by shaking 25 grams of material with 100 ml. of water for 30 minutes, filtering, and determining the elements on the flame photometer. The organic matter was estimated by oxidation with dichromic acid (5) and total nitrogen was determined by the Kjeldahl method (4). The results are presented in Table 20.

Loss on ignition was determined in a step-wise procedure by heating in a muffle furnace for one hour at each temperature used. The heating was done in steps of 100°C from 100°C to 1000°C. The loss on ignition results are presented in Table 19. The ignited samples were then dissolved in concentrated hydrochloric acid and analyzed for silica, aluminum, and iron by the procedure outlined by Prince (1) and for sodium, calcium, and potassium using the flame photometer. The results are presented in Table 21.

This analysis showed that the plaster samples were higher in silica than

Table 21

ANALYSES OF THE IGNITED RESIDUE OF TEMPLE PLASTERS AND ROCKS FROM TIKAL

Lab. No.	Sample Type	Silica	Combine Oxides	Calcium	Magnesium	Potassium	Sodium
		%	%	%	%	%	%
A-1	Rock	1.04	0.58	40.2	0.23	.072	.212
A-2	*Sac cab* (marl)	0.80	0.75	40.0	0.20	.067	.196
A-7	Lime	2.15	0.78	44.3	0.42	.159	.381
A-8	Exterior	1.49	1.34	39.0	0.27	.074	.259
A-9	Floor	1.53	1.35	38.0	0.38	.068	.194
A-10	Wall	1.79	1.43	38.6	0.28	.068	.232
A-11	Mortar	1.28	1.29	39.6	0.24	.068	.230

Table 22

THE SOLUTION OF SILICA, ALUMINA, AND IRON IN 0.5 N SODIUM HYDROXIDE (PPM)

Constituent	Fraction Analyzed	Laboratory Sample Number					
		A-1	A-2	A-8	A-9	A-10	A-11
		PPM	*PPM*	*PPM*	*PPM*	*PPM*	*PPM*
Silica	Sample	704	726	558	815	755	572
	Residue	1008	1302	3248	1794	2053	2171
	Total	1712	2028	3806	2609	2808	2743
Al_2O_3	Sample	646	662	1090	995	1882	1204
	Residue	310	458	320	607	447	683
	Total	956	1120	1410	1602	2327	1887
Fe_2O_3	Sample	6	16	8	5	6	6
	Residue	38	42	66	96	73	108
	Total	44	58	74	101	79	114
SiO_2/R_2O_3	Sample	1.84	1.83	0.86	1.39	0.68	0.81
	Residue	5.12	4.56	15.22	4.56	7.06	4.90
	Total	2.95	2.97	4.43	2.66	2.00	2.38

the native rocks, so an attempt was made to dissolve the extra silica from the plasters by digestion with 0.5 N sodium hydroxide (3). After digestion and washing with water the calcium carbonate was removed by washing with hydrochloric acid, and the insoluble residue again digested with 0.5 N sodium hydroxide. The results are presented in Table 22.

The acid insoluble residues, after removal of the sand size fraction, were analyzed for total nitrogen, organic matter, and differences in dehydration as outlined above for the plasters. Sodium carbonate fusion (1) was used in determining the silica, alumina, and iron of the insoluble residue. Results of these analyses are presented in Tables 23 and 24.

Table 23

ANALYSES OF THE ACID INSOLUBLE RESIDUE (LESS SAND FRACTIONS) FROM PLASTERS, LIMESTONE, AND CLAY MATERIALS

Lab. No.	Ignition Loss (a)	SiO_2	Al_2O_3	Fe_2O_3	SiO_2/R_2O_3	Total Nitrogen	Organic Matter (b)
A-1	13.3	55.2	23.5	3.8	3.60	0.40	6.46
A-2	10.9	51.5	28.4	4.4	2.79	0.08	2.89
A-2a	13.9	51.6	31.0	5.5	2.54	0.05	—
A-3	11.8	51.5	33.4	3.2	2.46	0.01	—
A-8	32.6	50.2	13.4	2.8	5.61	1.48	17.75
A-9	20.3	51.0	23.2	5.0	3.28	0.52	7.46
A-10	27.5	46.5	16.8	3.4	4.16	1.29	11.61
A-11	18.5	53.2	22.3	5.1	3.53	0.36	7.51
A-5	12.1	49.5	32.6	4.9	2.35	0.01	0.85

(a) Loss on Ignition between 105° and 900° Centigrade.
(b) Loss in weight of sample due to oxidation with 10% hydrogen peroxide.

Table 24

DEHYDRATION OF CLAY SAMPLES FROM PLASTERS OF TIKAL (SAMPLE WEIGHT AT 300°C AS UNITY)

Lab. No.	Plaster Sample	Per cent of Sample Lost at Each Temperature					
		400	500	600	700	800	900
A-1	Rock	0.7	3.4	5.5	6.0	7.1	8.9
A-2	*Sac cab* (marl)	0.0	3.6	6.1	7.7	9.0	9.9
A-8	Exterior	0.2	3.3	5.6	5.8	7.3	9.0
A-9	Floor	0.6	3.7	5.0	6.1	8.2	8.5
A-10	Wall	1.4	3.6	4.3	6.3	7.7	9.0
A-11	Mortar	0.8	3.0	4.3	6.2	7.5	9.0
A-3	Clay Ball	1.4	5.5	7.3	8.3	9.5	10.9
A-5	*Tintal*	1.0	5.4	6.8	8.1	9.3	10.8

An X-ray analysis was made of the powdered rocks and plasters and also of the insoluble residues. This work was done by Dr. S. B. McCaleb and his report for the rocks and plasters was as follows:

"The parent carbonate rock was identical for the 8″ hard (A-1) and the 6′ soft (A-2) material. It was dominantly $CaCO_3$, as Calcite, with a trace of Pirssonite ($Na_2CO_3:CaCO_3:2H_2O$). The fired 8″ layer material (A-7) is dominantly Portlandite $Ca(OH)_2$ with some Calcite, and traces of CaO and Kaolinite.

"All 'plaster' samples (Original room, A-8, A-9, A-10, and A-11) are composed of $CaCO_3$ (Calcite) of high purity. No Portlandite or CaO are present, and if these samples were ever fired, the plaster has been completely converted to $CaCO_3$. I would suspect that the samples were not fired.

"Conclusions: It appears unlikely that the plaster was fired, although the Portlandite is readily converted to Calcite. However, with respect to

the position (as mortar?) it seems improbable that all of the $Ca(OH)_2$ could be converted to the carbonate. The purity of both hard and soft carbonate rocks and the plaster, leaves little doubt that similar material was used as a raw material in initial plaster."[2]

His report on the acid insoluble residues which had been treated with 10% hydrogen peroxide to remove the organic matter was as follows:

"*Sample A-1* [Hard Surface Rock]
Whole powder showed the insoluble residue to be dominantly quartz with some montmorillonite.
Silt: (50-2 microns) Quartz, montmorillonite, illite and feldspar
Clay: (less than 2 microns) Montmorillonite with small amounts of kaolinite and quartz
"*Sample A-2* [Soft Rock (marl): *Sac cab*]
Whole powder: Equal amounts of quartz and montmorillonite
Silt: Quartz equal to montmorillonite with feldspar and trace of talc
Clay: Montmorillonite, quartz, feldspar and some kaolinite
"*Sample A-7* [Burned Limestone]
Whole powder: Dominantly quartz with some alpha cristobalite
Silt: Powder: Quartz, talc and feldspar; Oriented slides: quartz and feldspar
Clay: Quartz, cristobalite, and trace of montmorillonite
"*Sample A-8* [Exterior plaster]
Whole powder: Quartz equal to montmorillonite
Silt: Quartz, feldspar and trace of montmorillonite
Clay: Montmorillonite and trace of kaolinite
"*Sample A-9* [Floor Material]
Whole powder: Montmorillonite equal to quartz and trace kaolinite
Silt: Quartz, montmorillonite and feldspar
Clay: Montmorillonite, quartz, feldspar, and kaolinite
"*Sample A-10* [Interior wall plaster]
Whole powder: Quartz equal to montmorillonite plus some feldspar
Silt: Not sufficient sample
Clay: Poorly crystalline quartz and montmorillonite—probably some amorphous silica
"*Sample A-11* [Masonry mortar]
Whole powder: Montmorillonite equal to quartz and some interlayered illite montmorillonite
Silt: Quartz and montmorillonite
Clay: Montmorillonite, kaolinite, and feldspar
"*Sample A-12* [Austin chalk from Renner, Texas]
Whole powder: Quartz, montmorillonite and feldspar
Silt: Quartz, montmorillonite, feldspar and illite with trace kaolinite
Clay: Montmorillonite, quartz, feldspar and trace of kaolinite"

[2] Letter dated March 2, 1960 from Dr. S. B. McCaleb, Production Department, Research and Development Division, Sun Oil Company, 503 N. Central Expressway, Richardson, Texas.

"Sample A-7 is the only sample which has a definitely different source material as shown by the cristobalite and trace of talc. Note that A-2 had a trace of talc in the silt fraction. Sample A-10 with the amorphous type of crystallite may be significant in the discussion of this material. The more poorly crystalline montmorillonite may have been partially decomposed by the insoluble residue treatment and may account for the apparent difference observed. However, this may be significant in being a different type of material originally."[3]

The two clay samples were interpreted as follows:

"1. Tikal A-5 [sample from the *tintal*]

Powdered specimen contains montmorillonite, gypsum, quartz and kaolinite.

Silt-size: (50-2 microns) contains montmorillonite, gypsum, kaolinite, and a colloidal material giving a bulge 24–30° 2θ. This is probably iron, silica, and perhaps some gypsum. This is a peculiar feature of both clay [and] silt-sized material.

Clay size: (less than 2 microns) Dominantly montmorillonite with small amounts of kaolinite.

"2. Tikal A-3 (Red clay ball in soft carbonate rock)

Powdered sample contains vermiculite and traces of quartz, gypsum, kaolinite, and calcite. The red coloration material is preferentially concentrated in the silt-sized material.

Silt size: (50-2 microns) Vermiculite, gypsum, kaolinite, feldspar and the colloidal iron and silica material similar to silt of sample A-5.

Clay size: (less than 2 microns) Vermiculite and traces of kaolinite and gypsum."[4]

DISCUSSION

The data in Table 19 show that the plaster samples contained significantly more acid insoluble residue than either of the rock materials of the area. This means that the limestone used in the plasters was brought in from some other area or that extra clay was added when making the plasters. If the material screened from the very fine *sac cab* were ground and the two materials mixed together the clay content of the mixture would be about the same as that of the plasters. This does not appear to be the approach used because the clay present in the material removed by screening was red and gives a reddish cast to the mixture. There was no reddish cast in the plasters and mortar.

The composition of the clay isolated from the *tintal* sample (A-5) was very similar to the composition of the clay isolated from the plasters and mortar (see X-ray analysis). In addition, this material is white when wet and cream colored when dry and would not change the color of the plaster if added to the limestone used.

[3] Letter dated December 22, 1960 from Dr. McCaleb.
[4] Letter of March 2, 1960. Ibid.

The ball of red clay from the marl in Tikal contained vermiculite but there was no vermiculite in the plasters. This suggests that the red clay from the marl was not used in the plasters.

Sand definitely was not used in these plasters and mortar. The material of sand size was negligible in both plasters and rocks, and part of this was organic in nature. This was especially true of the plasters as shown by the quantity of fibers separated with the sand.

The figures on loss on ignition between 100 and 600 degrees show that the plasters contained more organic material than the rocks (See Table 19 and Table 23), especially the exterior and interior wall plasters (sample A-8 and A-10) as shown by the data on easily oxidizable organic matter presented in Tables 20 and 23. Samples of both the interior and exterior wall plaster were much higher in organic matter than the two rock materials. The floor plaster and masonry mortar were also higher in organic matter than the rock materials but the differences were not as great. This indicates that organic materials were used in all samples but that the material for floors and mortar was different from that used in the wall plasters.

Although both the interior and exterior wall plasters were higher in total nitrogen and easily oxidizable organic matter than the other plasters and rocks, evidence indicates that different plant materials were used in the two wall plasters. The ratio of easily oxidizable organic matter to nitrogen was 13.0 for the exterior wall plaster but only 5.2 for the interior wall plaster. For the acid insoluble residues these ratios were 12 and 9, respectively. Furthermore, the fibers isolated from interior plaster were white while those isolated from the exterior wall plaster were black. The organic matter to nitrogen ratio of the floor material was 16.8 while that of the mortar was 13.8. These values are close enough to that of the exterior plaster to be considered the same. However, if the same material was used in these two materials as was used in the exterior wall plaster, a much smaller amount was used since they contained less than one-half the amount of easily oxidizable organic matter as the wall plasters, and the insoluble residues also contained less than wall plasters.

The analyses of the ignited samples of rocks and plasters (Table 21) show the plasters were higher in silica and combined oxides of iron and aluminum than either of the rock materials. They were correspondingly lower in calcium. The materials do not appear to differ appreciably in magnesium, potassium, and sodium as determined by this method. However, the data for water soluble calcium, potassium, and sodium (Table 20) show the two wall plasters to be definitely different from the rock samples in these components. This may simply be incidental to the type of materials used in making the wall plasters. The water soluble calcium content of the exterior wall plaster was much higher than for the other samples and exceeds the the solubility of gypsum by 4 to 5 fold. This suggests that the soluble calcium in this sample was not introduced by the water used. The soluble sodium and calcium content of the other plasters was about the same as for the soil from the *tintal* which suggests that they could have been introduced in the waters used. The water soluble potassium content of both wall

plasters was higher than for any of the other materials analyzed which may mean it was introduced with the plant extracts used in these materials.

The dehydration data in Table 24 show that the acid insoluble residues from the plasters and mortar gave essentially the same pattern of weight loss as that from the rocks. This is evidence that the material used in the plasters was never burned because the clays would have been dehydrated and would not have given curves typical of the rocks and soils of the area. Since all the data indicate that the limestone was not burned before making the plasters, an attempt was made to determine if the rocks would "set-up" and harden sufficiently, after mixing with water, to be used for plasters. This was done by preparing a series of briquettes ½ x ½ x ½ inch, allowing them to dry for one week and measuring the pressure required to crush them. The pressure was applied until the briquette was crushed and not merely fractured.

The amount of water soluble calcium present in the plasters and the fact that gypsum appears to be present in many of the soils of the area suggests that the water used in making the plasters may have been saturated with gypsum. Accordingly, briquettes were prepared with water saturated with calcium sulfate.

The acid insoluble residue found in the plasters indicated that extra clay had been added to the rocks of the area in making the plasters, so briquettes were prepared by adding dry clay isolated from the *tintal* soil sample (A-5) and also by using a suspension of colloidal clay from the same soil sample instead of water to prepare the briquettes. Briquettes were also prepared by adding sufficient water soluble silicate of soda to the ground rock to bring the silica content of the mixture to that of the exterior wall plaster.

To test the effects of plant juices on the rock-water mixtures, an extract was made by macerating green soybean plants thoroughly with distilled water in a Waring blender and filtering through a nylon mesh. This water extract was used to prepare briquettes from the fine *sac cab* (A-2). In addition juice was pressed from the green soybean plants with a Carver press and used without dilution to prepare briquettes from the same material.

An extract was prepared from dry birdsfoot trefoil hay using the Waring blender and distilled water as described above. This extract was used to prepare briquettes of the hard rock (A-1). The ground plasters were also mixed with distilled water to the proper consistency and molded into briquettes to test how well they would set-up after being powdered. The results of these tests are presented in Table 25.

The hard rock of the area made briquettes that were much more resistant to crushing than those from the fine *sac cab*. The fine *sac cab* had practically no cohesion when wetted to form a molding mixture. It was very difficult to work or to wet to the right consistency. Addition of clay improved the molding characteristics of this fine material and increased the resistance of the briquettes to crushing.

Use of water saturated with calcium sulfate to prepare the briquettes

Table 25

CRUSHING STRENGTH (LBS. PER SQ. IN.) OF BRIQUETTES PREPARED FROM GROUND PLASTER AND ROCKS WITH VARIOUS ADDITIVES

Water Only		Effects of Additives on Samples A-1, A-2		
Lab. No.	Hardness	Additive	Hardness	
			Hard Rock	*Sac cab* (marl)
A-1	45.6 ± 1.9	None	45.6 ± 1.9	21.3 ± 1.1
A-2	21.3 ± 1.1	Clay Suspension	50.5 ± 3.2	20.0 ± 1.0
A-2a	190.0 ± 6.0	1.3% Clay	47.7 ± 2.8	31.6 ± 1.4**
A-8	48.2 ± 2.4	$CaSO_4$ Water	29.0 ± 2.8**	17.2 ± 0.8*
A-9	124.8 ± 6.0	1.3% Clay + $CaSO_4$	49.9 ± 4.3	27.4 ± 1.2**
A-10	35.7 ± 2.7	Sodium Silicate	110.5 ± 6.6**	122.6 ± 7.4
A-11	83.0 ± 4.8	Plant Extract(a)	39.8 ± 3.6	20.7 ± 0.7
		Plant Extract(b)	37.6 ± 2.6*	25.2 ± 0.9*

* Significantly different from rock with no additive; * at 5% level; ** at 1% level.

(a) For the hard rock sample the extract was of dry Birdsfoot trefoil hay with the cooilldal material settled out. For the *sac cab* it was from green soybean plants with the colloidal material in suspension.

(b) For the hard rock sample this was the same water extract of Birdsfoot trefoil with colloidal material in suspension but for the *sac cab* it was undiluted juice pressed from green soybean plants.

greatly reduced the crushing resistance of both materials. Silicate of soda markedly increased the crushing resistance of briquettes from both materials, but had a greater effect on those prepared from the fine *sac cab*. Soybean juice improved the molding properties of the briquettes prepared from the *sac cab* and also increased their resistance to crushing. The water extracts decreased the resistance to crushing of briquettes from both materials.

With the exception of the interior wall plaster, all plasters formed briquettes that were more resistant to crushing than either of the rock materials tested. The material screened from the *sac cab* was high in clay and briquettes made from it were very resistant to crushing. However, the clay present is red in color and yielded light red or pink briquettes which in no way resembled the colors of the plasters.

CONCLUSIONS

Based on the analyses made the following conclusions appear to be justified.

1. Sand was not used in making the plasters since the material separated on a 300-mesh sieve was negligible.

2. The limestone was not burned to make the plasters. This conclusion is supported by the X-ray analysis of both the plaster and the acid insoluble residue isolated from the plasters. The presence of cristobalite in the insoluble residue from the burned lime and the lack of it in the plasters is evidence in favor of this conclusion. The chemical analysis and dehydration curves of the insoluble residues also support this point. The clays isolated from the plasters have a typical dehydration curve, are montmorillonitic and similar to the clay isolated from the soils of the area (2).

3. If local rocks were used for the plasters extra clay was added since all plasters were higher in acid insoluble residue than the rocks, and the masonry mortar was higher than the plasters.

4. Plant extracts (or juice) or some other organic material was added to the plasters, and larger quantities were used in the wall plasters than in the floor material or mortar. Furthermore, the organic material in the exterior wall plaster differs from that of the interior wall plaster in that it was black instead of white and more carbonaceous. This latter point is indicated by the organic matter to nitrogen ratio of the two samples.

5. The fibers present are probably incidental since the quantity was too small to have any binding effect, *per se*.

6. The lack of cohesion in the very fine *sac cab* when wetted makes this a poor raw material for plaster. However, the addition of 1.3% extra clay or of water soluble silicate improves this characteristic.

7. The wall plasters were considerably higher in silica than the rocks or floor material and mortar. This is shown by the high silica-sesquioxide ratio shown in Table 23 and the silica dissolved in the 0.5 N sodium hydroxide (Table 22).

This extra silica in the wall plasters may have been added as soluble silica in the organic materials used.

8. The water soluble potassium content of the wall plasters probably means plant extracts high in potassium were used in making these plasters. The lower potassium content of the floor material and mortar suggests that different extracts were used in these materials.

9. The use of a plant extract or juice to prepare pure white plaster such as the interior wall plaster (A-10) would appear to require some decoloration process, otherwise the mixture would probably vary from red, yellow to green.

10. The findings reported indicate the need for additional investigation of these materials, especially of the interior wall plaster which should probably be compared with interior wall plasters from sources other than Temple I.

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THE SOILS AND VEGETATION OF A RELICT AREA OF BLACKLAND PRAIRIE

W. Derby Laws and Donovan S. Correll

Today, very little of the vast Blackland Prairie of North Central Texas is left in its original pristine condition and the fragments that still remain are few. In 1944 members of the staff of Texas Research Foundation, realizing that the last vestiges of undisturbed prairie would soon be gone, initiated the study of a relatively undisturbed prairie tract near Renner in order to gather data on its soil and vegetative composition. This paper deals with the soil phase of the study. A subsequent paper will treat the vegetative aspect.

The area under study, known as the Stults Meadow, was part of a parcel of land settled by William Newton Stults in 1874. It is located in Dallas, Texas, at the southwest corner of the intersection of Beltline Road and Coit Road. Stults, a native of Augusta County, Virginia, raised some cattle, and grew wheat, oats and corn, but no cotton. From the very beginning the tract now known as Stults Meadow was set aside solely for hay. It was the custom to cut the meadow once a year. Although, at first, the meadow was sometimes burned in the late fall or early spring, Mr. James Emery Stults, a grandson, says that besides never having been plowed or grazed, the meadow, within his memory of fifty odd years, was never burned. Because of this favored treatment, the tract is doubtless representative today of the Blackland Prairie that originally covered a large part of North Central Texas.

PART I: AN INVESTIGATION OF THE SOILS OF THE STULTS MEADOW, A RELICT AREA OF BLACKLAND PRAIRIE

W. Derby Laws[1]

At the time of sampling the meadow was bounded on the west by wheat stubble land which had been cropped continuously for 50 to 60 years. A wire fence and a row of trees separated the meadow from this cultivated field. It was bounded on the north by Beltline Road, and the land across the road was formerly the Huffhines farm. When sampled this cultivated field was in "beds." Ten years prior to this study Mr. Huffhines stated that his farm had been in cotton continuously for 90 years and that most of the

[1] Formerly, Principal Soil Scientist, Texas Research Foundation, Renner, Texas, now Professor of Agronomy, Brigham Young University, Provo, Utah.

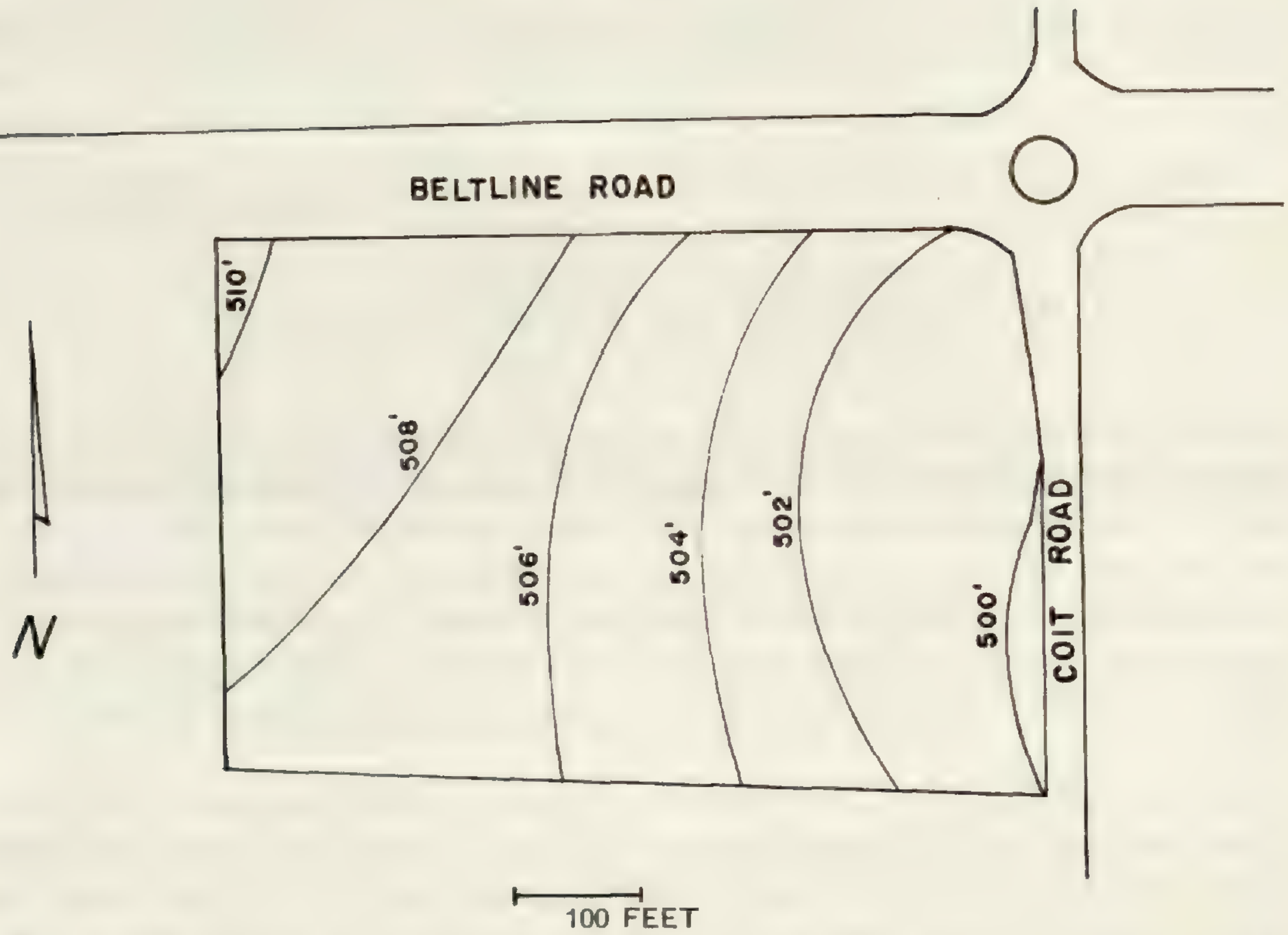

Fig. 37. A contour map showing the slope and general location of the meadow studied.

time the rows had run up and down the hill. The meadow is bounded on the east by Coit Road, and across the road was a pasture of grass and weeds. This pasture had the appearance of having never been plowed in that it had the typical "hog-wallow" or "buffalo-wallow" topography common to the Blackland area. However, such a topography can develop in land previously plowed if left un-tilled for a long period of time. South of the meadow was another such pasture which also had the typical "buffalo-wallow" topography and, at least for the past 15 or 20 years, had been in buffalo grass.

The size and general slope of the meadow are shown in Fig. 37. Across the west end, down the south side and across the east end, the meadow was pocketed with the typical undulating topography or "buffalo-wallows." However, along the north side about the middle half and extending about half way across the meadow southward, there were no such undulations. However, the soil in the flat area does not differ enough from the soil in the undulating area to justify classification as a different soil type. Both are classified as Houston black clay.[2]

PROCEDURES AND RESULTS

Holes were dug to a depth of 40 inches and core samples and samples for laboratory analysis were obtained at the depths indicated in the tables.

[2] Verbal communication from James E. Bower, Soil Scientist, SCS, U. S. D. A. August 15, 1961.

Table 26

THE EFFECTS OF CULTIVATION OR INTENSIVE GRAZING ON SOME PHYSICAL PROPERTIES OF HOUSTON BLACK CLAY (VOLUME PERCENTAGES)

Meadow Location	Sampling Depth	Bulk Density		Field Capacity		Total Pores	
		Meadow	Adjoining	Meadow	Adjoining	Meadow	Adjoining
West End	1″	0.84	0.91	38.3	41.9*	62.4	61.0
	10″	1.01	1.04	40.7	44.4*	56.1	55.5
	20″	1.09	1.08	40.6	43.2*	52.6	54.6
	30″	1.16	1.14	41.2	42.2	51.0	53.4
	40″	1.15	1.18	41.0	42.0	51.6	52.0
	L.S.D.	0.07	0.11	N.S.	N.S.	3.8	3.8
North Side	1″	0.85	1.05*	38.5	41.1	60.5	56.6*
	10″	1.04	1.16*	39.2	41.8	55.6	51.3*
	20″	1.18	1.20	37.5	39.3	49.7	47.3
	30″	1.28	1.29	34.4	37.0	47.8	46.2
	40″	1.33	1.39	30.1	37.1*	45.1	44.4
	L.S.D.	0.02	0.11	4.1	6.7	3.8	4.3
East End	1″	0.96	1.00*	41.7	41.4	57.9	56.5
	10″	1.06	1.05	40.0	41.0	56.0	54.2
	20″	1.12	1.11	41.1	43.6*	55.5	54.4
	30″	1.16	1.15	42.3	43.9	54.6	54.6
	40″	1.19	1.18	42.5	44.3	53.5	55.6
	L.S.D.	0.05	0.02	1.8	2.3	2.7	2.1
South Side	1″	0.87	0.90	40.9	43.8*	64.1	58.0*
	10″	0.99	1.06*	39.9	41.9	59.2	54.0*
	20″	1.06	1.15*	41.1	41.4	57.2	52.3*
	30″	1.16	1.23*	40.1	40.4	55.4	50.8*
	40″	1.18	1.29*	41.1	39.0	51.8	47.1*
	L.S.D.	0.06	0.05	N.S.	2.7	5.1	3.5

* Significantly different from the corresponding meadow sample at p = 5%.

Three sites were chosen along each side of the meadow. Pits were dug in both the meadow and the cultivated field or pasture, directly opposite each other at each site. Measurements of the total pore space, field capacity, and bulk density (Table 26) were made on the core samples taken.[3] Bulk samples from each location and each profile were taken into the laboratory, screened through a 10-mm. round hole sieve, and thoroughly air dried. Representative samples were then ground to pass a 60-mesh sieve and used in the chemical analysis. Organic matter was estimated by wet oxidation with dichromic acid (6), total nitrogen by the Kjeldahl method (4), and total phosphorus by a nitric-perchloric acid digestion method (Table 27). The calcium, potassium, and sodium in the filtrate from the phosphorus were determined with the flame photometer (Table 28).

[3] The core samples were taken by Dr. Hans Brawand, Texas Research Foundation, who also made all the measurements on them.

Aggregation Analysis. The aggregation analysis was made by the wet sieving principle described by Yoder (8). The air-dried bulk samples were screened with round holed sieves so that only the particles between 5 mm. and 3 mm. were used in the analysis. A 25 gram sample was stored in an atmosphere of 25 per cent relative humidity for two months before making the analysis, because it was found that the hygroscopic moisture content of the aggregates before wetting has a marked effect on the results obtained be wet sieving (2). After this storage period the samples were placed directly on the sieve nest which was already immersed in water, allowed to soak for 15 minutes, and then wet sieved at the rate of 14 strokes per minute through a distance of 1 inch for 30 minutes. The screen sizes were 2-mm., 1-mm., and ½-mm. round holes, and a 60-mesh and a 100-mesh wire screen.

The aggregation data expressed as mean weight diameter (7) are presented in Fig. 38 and Tables 29 to 32. It is immediately apparent that the

Table 27

THE EFFECTS OF CULTIVATION OR INTENSIVE GRAZING ON THE PHOSPHORUS, NITROGEN, AND ORGANIC MATTER CONTENT OF HOUSTON BLACK CLAY (ALL VALUES ARE PERCENTAGES)

Meadow Location	Sampling Depth	Organic Matter		Nitrogen		Phosphorus	
		Meadow	Adjoining	Meadow	Adjoining	Meadow	Adjoining
West End	0–5″	6.29	3.48*	.251	.129*	.061	.047*
	5–10″	4.91	3.20*	.171	.132*	.056	.043*
	10–20″	3.77	3.00*	.124	.116	.050	.045
	20–30″	2.97	2.63	.098	.095	.043	.043
	30–40″	2.40	1.81	.077	.068	.044	.042
	L.S.D.	0.74	0.66	.039	.022	.007	N.S.
North Side	0–5″	7.45	3.52*	.343	.138*	.071	.050*
	5–10″	5.63	3.19*	.252	.128*	.066	.046
	10–20″	4.01	2.69*	.179	.105*	.057	.043*
	20–30″	2.30	2.06	.117	.085*	.049	.043
	30–40″	0.97	1.26	.062	.052	.048	.048
	L.S.D.	0.80	0.56	.032	.032	.005	N.S.
East End	0–5″	5.41	5.55	.216	.196	.028	.032*
	5–10″	4.16	4.38	.152	.151	.024	.026
	10–20″	3.77	3.71	.127	.118	.021	.021
	20–30″	2.77	2.67	.091	.087	.018	.021
	30–40″	1.60	2.20	.051	.068	.016	.019
	L.S.D.	0.78	0.50	.031	.026	.002	.005
South Side	0–5″	6.77	6.46	.280	.254	.050	.056
	5–10″	5.02	5.64	.190	.208	.042	.049
	10–20″	4.01	3.94	.139	.141	.040	.047
	20–30″	2.34	2.18	.092	.086	.036	.042
	30–40″	2.09	1.69	.080	.068	.037	.041

* Significantly different from the corresponding meadow sample at p = 5%.

meadow has a much better degree of aggregation than the cultivated soils and generally better than the pasture soils. The mean weight diameter gives extra weight to the larger sizes so that the maximum value obtainable under conditions of this experiment would be 0.350 cm. Such a value would be obtained only if 100% of the soil remained as water stable aggregates on the 2-mm. sieve.

Porosity Measurements. The total porosity was taken as the per cent (by volume) of water held by the soil after saturating for 48 hours. Field capacity (by volume) was determined by placing the saturated cores on a layer of air dry soil 4 to 5 inches deep and allowing to drain for 48 hours. The difference in these two values was considered as a non-capillary pore space. The results are summarized in Table 26, and Fig. 39. The meadow was higher in total porosity than the cultivated or pasture soils at all depths

Table 28

THE EFFECTS OF CULTIVATION OR INTENSIVE GRAZING ON THE POTASSIUM, CALCIUM, AND SODIUM CONTENT OF HOUSTON BLACK CLAY (ALL VALUES ARE PERCENTAGES)

Meadow Location	Sampling Depth	Potassium		Calcium		Sodium	
		Meadow	Adjoining	Meadow	Adjoining	Meadow	Adjoining
West End	0–5″	0.63	0.60	3.67	2.17	.103	.072
	5–10″	0.62	0.64	3.95	2.18	.113	.074
	10–20″	0.57	0.62	5.08	2.82	.127	.083
	20–30″	0.57	0.64	6.30	3.68	.149	.103
	30–40″	0.57	0.62	6.80	5.37	.167	.139
	L.S.D.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
North Side	0–5″	0.57	0.54	4.07	5.30	.110	.132
	5–10″	0.55	0.52	5.80	6.50	.142	.158
	10–20″	0.52	0.50	8.77	8.53	.199	.198
	20–30″	0.49	0.49	13.35	10.53	.287	.239
	30–40″	0.44	0.47	20.03	13.52	.394	.276
	L.S.D.	0.07	N.S.	5.93	5.42	.080	.098
East End	0–5″	0.49	0.53	1.70	1.02	.060	.049
	5–10″	0.47	0.47	2.23	1.17	.072	.052*
	10–20″	0.47	0.47	1.52	0.92	.059	.054
	20–30″	0.49	0.49	1.88	0.92*	.066	.054
	30–40″	0.51	0.43	3.08	0.95*	.094	.053*
	L.S.D.	N.S.	N.S.	0.79	N.S.	.016	N.S.
South Side	0–5″	0.57	0.62	2.25	2.37	.075	.085
	5–10″	0.48	0.59	3.07	3.23	.101	.094
	10–20″	0.51	0.53	3.97	6.12*	.117	.140
	20–30″	0.48	0.51	5.37	8.95*	.152	.219*
	30–40″	0.52	0.51	5.95	9.55*	.148	.240*
	L.S.D.	.06	.07	1.42	1.92	.031	.059

* Significantly different from the corresponding meadow sample at p = 5%.

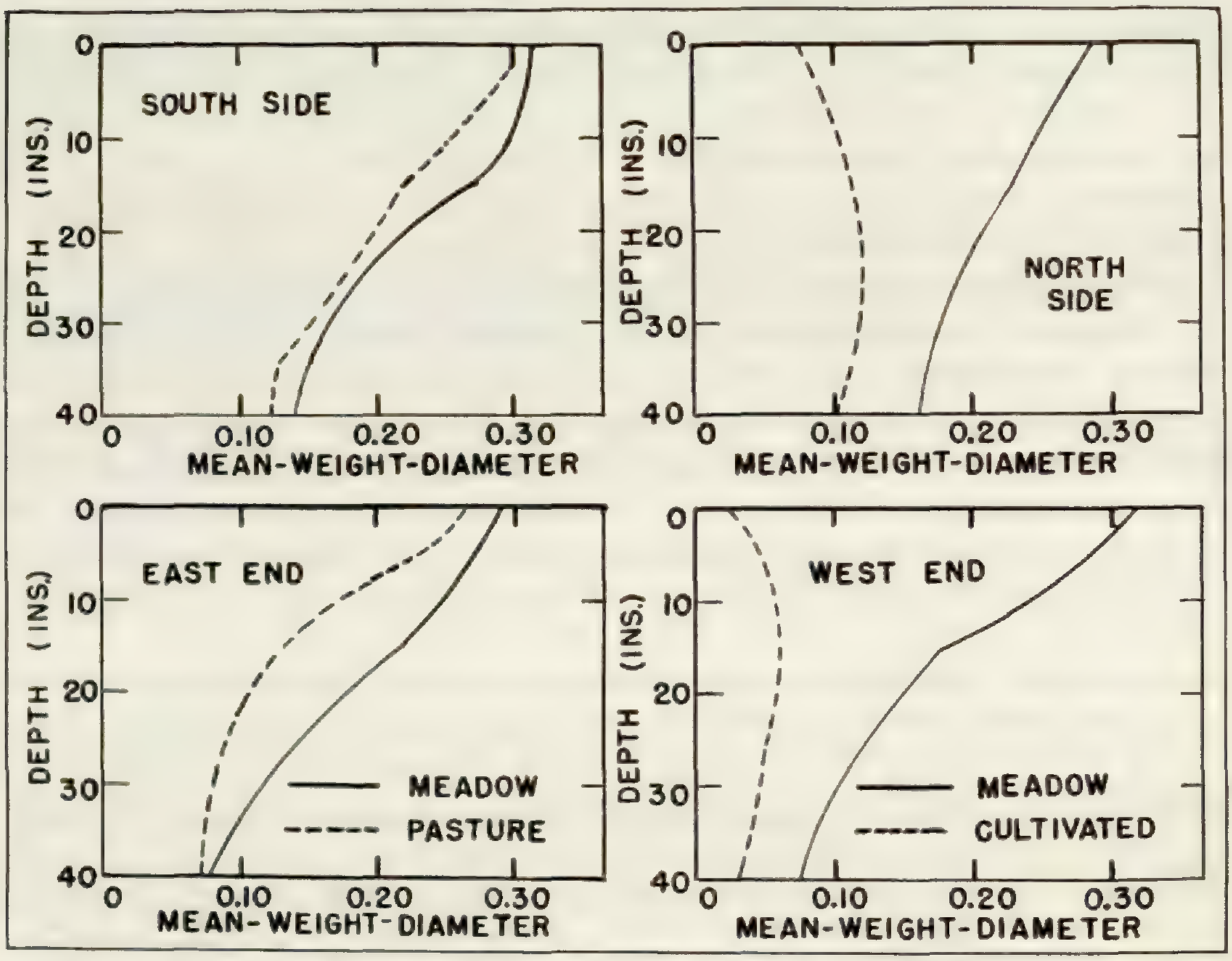

Fig. 38. Effects of cultivation and grazing on the aggregate stability of Houston black clay.

and all locations. The meadow soils were generally lower in field capacity than the corresponding cultivated or pasture soils. These findings are in agreement with those of Laws and Evans (3).

DISCUSSION

Aggregation Analysis. The data plotted in Fig. 38 show that the aggregate stability was markedly affected by cultivation to a depth of 40 inches although the organic matter content of the meadow soil was no higher than that of the cultivated soil below a depth of 20 inches. This suggests a possible difference in the type of organic matter present in the two soils. However, no attempt was made in the present study to clarify this point.

The aggregation of the meadow soils did not vary with site at each location as the organic matter content (see Tables 29 to 32), which indicates that other factors, in addition to organic matter content, influence aggregate stability in these soils. This is also indicated by comparing the pasture soils with the native meadow. Although there was no significant difference in the organic matter content of these two soils there was a difference in the aggregation.

Porosity Measurements. The data in Table 26 show the effects of cultivation or intensive grazing of buffalo grass on some of the physical properties

of Houston black clay. Along the west end of the meadow and over in the cultivated soil which was cropped to wheat in 1958 and which had been cultivated 50 to 60 years, there was no significant difference in the bulk density or total porosity of the soils. However, the cultivated soil had a significantly higher field capacity down to 20-inch depth. Along the north side of the meadow the cultivated soil was higher in bulk density at the 1-inch depth and also at the 10-inch depth. Below that there was no significant difference between cultivated soil and meadow soil. The field capacities were not significantly different along the north side except at the 40-inch depth; however, the meadow soil was much higher in non-capillary pore space or air space than the cultivated soil obtained from the Huffhines' farm where the land had been in continuous cultivation for over 100 years (See Fig. 39). There was no difference in the physical properties of the

Table 29

THE RELATIONSHIP OF SAMPLING SITE TO SOIL PROPERTIES AT THE WEST END OF STULTS MEADOW

Soil Property Measured	Soil	Position of site			L.S.D. at P = 5%	Location Average
		South	Middle	North		
Bulk Density	Meadow	1.06	1.06	1.03	.05	1.05
	Cultivated	1.05	1.07	1.09	.08	1.07
Field Capacity	Meadow	40.8	40.7	39.6	N.S.	40.4
	Cultivated	43.7	42.1	42.5	N.S.	42.8**
Non-Capillary Pore Space	Meadow	13.9	14.8	14.5	(a)	14.4
	Cultivated	12.6	13.4	11.7	(a)	12.6
Aggregation	Meadow	.190	.192	.196	N.S.	.192
	Cultivated	.032	.068	.041	.020	.047**
Organic Matter	Meadow	3.72	4.13	4.36	.57	4.07
	Cultivated	2.86	2.58	3.03	.51	2.82**
Nitrogen	Meadow	.120	.134	.178	.030	.144
	Cultivated	.103	.109	.111	.017	.108**
Phosphorus	Meadow	.041	.051	.058	.005	.050
	Cultivated	.042	.045	.045	.009	.044**
Potassium	Meadow	.567	.575	.638	.062	.593
	Cultivated	.637	.572	.670	.066	.626*
Calcium	Meadow	4.90	6.51	4.07	N.S.	5.16
	Cultivated	1.73	4.16	3.84	N.S.	3.24**
Sodium	Meadow	.132	.156	.107	N.S.	.132
	Cultivated	.064	.112	.107	N.S.	.094**

(a) Statistical analysis not made.
* Significantly different from the meadow soil (*) at p = 5%, (**) at p = 1%.

Stults meadow and the buffalo grass pasture along the east end. Along the south side the bulk density of the pasture soil was significantly higher than the bulk density of the meadow soil, and the total pore space was significantly lower than that for the meadow soil. The non-capillary pore space was also significantly lower (See Fig. 39).

Chemical Analysis. The data in Table 27 show the effects of cultivation on organic matter, nitrogen, and phosphorus content of the soil by depths. The meadow soil along the west end and also along the north side was significantly higher in organic matter content than was the cultivated soil down to a depth of 20″. Below that depth the differences were not statistically significant. This is in agreement with the data of Laws and Evans (3). The nitrogen and phosphorus content of the meadow soil was also significantly higher than that of the cultivated soil down to a depth of 20 inches.

Table 30

THE RELATIONSHIP OF SAMPLING SITE TO SOIL PROPERTIES AT THE EAST END OF STULTS MEADOW

Soil Property Measured	Soil	Position of site			L.S.D. at P = 5%	Location Average
		South	Middle	North		
Bulk Density	Meadow	1.08	1.09	1.11	.04	1.10
	Pasture	1.07	1.12	1.10	.02	1.10
Field Capacity	Meadow	42.0	38.5	44.1	1.4	41.5
	Pasture	44.6	41.7	42.2	1.8	42.8**
Non-Capillary Pore Space	Meadow	14.0	16.8	11.1	(a)	14.0
	Pasture	12.1	11.9	12.7	(a)	12.2
Aggregation	Meadow	.202	.200	.202	N.S.	.202
	Pasture	.149	.166	.135	N.S.	.150**
Organic Matter	Meadow	3.34	3.16	4.13	0.60	3.54
	Pasture	3.95	3.24	3.91	0.39	3.70
Nitrogen	Meadow	.125	.107	.150	.024	.127
	Pasture	.142	.094	.137	.020	.124
Phosphorus	Meadow	.024	.018	.021	.002	.021
	Pasture	.028	.021	.023	.004	.024**
Potassium	Meadow	.487	.457	.508	.040	.484
	Pasture	.543	.433	.455	.083	.477
Calcium	Meadow	1.79	3.48	0.98	1.92	2.08
	Pasture	0.85	1.57	0.56	0.31	0.99**
Sodium	Meadow	.066	.096	.048	.013	.070
	Pasture	.052	.063	.042	.005	.053**

(a) Statistical analysis not made.
* Significantly different from the meadow soil at (*) p = 5%, (**) p = 1%.

The organic matter, nitrogen, or phosphorus content of the meadow soil did not differ significantly from the soil which had grown buffalo grass pasture for many years.

The potassium, calcium, and sodium in the filtrate from the phosphorus analysis were determined by the Perkin-Elmer flame photometer and the results are presented in Table 28. The potassium released by the nitric-perchloric acid digestion was approximately equal for all soils. It decreased with depth of sampling, which is in direct contrast to the calcium and sodium released by this digestion. The potassium released by this digestion is not the same as the total potassium content of the soil. It was found to be closely correlated (r = .986) with the fixed potassium determined by the boiling nitric acid method of Rouse and Bertramson (5) and the fixed

Table 31

THE RELATIONSHIP OF SAMPLING SITE TO SOIL PROPERTIES ON THE NORTH SIDE OF STULTS MEADOW

Soil Property Measured	Soil	Position of site			L.S.D. at P = 5%	Location Average
		West	Middle	East		
Bulk Density	Meadow	1.13	1.12	1.15	N.S.	1.13
	Cultivated	1.31	1.14	1.19	0.08	1.22**
Field Capacity	Meadow	34.1	34.4	39.4	3.2	36.0
	Cultivated	35.2	40.3	42.2	5.2	39.3**
Non-Capillary Pore Space	Meadow	16.3	17.9	13.2	(a)	15.8
	Cultivated	8.9	10.5	10.4	(a)	9.9
Aggregation	Meadow	.238	.234	.201	N.S.	.224
	Cultivated	.155	.067	.074	.052	.099**
Organic Matter	Meadow	4.36	4.11	3.75	0.62	4.07
	Cultivated	2.25	2.77	2.61	0.43	2.54**
Nitrogen	Meadow	.209	.198	.166	.025	.191
	Cultivated	.085	.124	.096	.012	.102**
Phosphorus	Meadow	.064	.064	.046	.004	.058
	Cultivated	.057	.046	.035	.012	.046**
Potassium	Meadow	.477	.514	.545	N.S.	.512
	Cultivated	.453	.543	.510	.049	.502
Calcium	Meadow	11.79	12.10	7.32	N.S.	10.40
	Cultivated	15.76	5.28	5.59	4.20	8.88
Sodium	Meadow	.257	.252	.170	.062	.226
	Cultivated	.340	.127	.134	.076	.201

(a) Statistical analysis not made.

* Significantly different from the corresponding meadow soil at (*) p = 5%, (**) p = 1%.

Table 32

THE RELATIONSHIP OF SAMPLING SITE TO SOIL PROPERTIES ON THE SOUTH SIDE OF STULTS MEADOW

Soil Property Measured	Soil	Position of site			L.S.D. at P = 5%	Location Average
		West	Middle	East		
Bulk Density	Meadow	1.06	1.03	1.06	N.S.	1.05
	Pasture	1.12	1.13	1.12	N.S.	1.12**
Field Capacity	Meadow	41.6	39.2	41.3	1.6	40.6
	Pasture	43.0	40.4	40.5	2.1	41.3
Non-Capillary Pore Space	Meadow	17.8	16.6	15.2	(a)	16.5
	Pasture	9.2	11.6	12.6	(a)	11.1
Aggregation	Meadow	.245	.248	.241	N.S.	.244
	Pasture	.219	.223	.214	N.S.	.219**
Organic Matter	Meadow	4.09	3.89	4.15	N.S.	4.05
	Pasture	4.04	3.98	3.93	N.S.	3.98
Nitrogen	Meadow	.154	.167	.147	.015	.156
	Pasture	.134	.179	.141	.033	.151
Phosphorus	Meadow	.038	.043	.042	.002	.041
	Pasture	.042	.049	.049	.009	.047**
Potassium	Meadow	.518	.514	.503	N.S.	.512
	Pasture	.595	.540	.515	.056	.550**
Calcium	Meadow	3.14	4.95	4.27	1.10	4.12
	Pasture	5.80	6.34	5.99	N.S.	6.04**
Sodium	Meadow	.092	.138	.125	.024	.119
	Pasture	.146	.170	.152	N.S.	.156

(a) Statistical analysis not made.

* Significantly different from the corresponding meadow soil at (*) p = 5%, (**) p = 1%.

potassium determined by the heating method of Kalterman and Truog (1) (r = .997).[4]

The calcium content of the cultivated soil was lower than that of the meadow soil directly opposite. This was also true for the buffalo grass pasture at the east of the meadow. However, on the south side the calcium was higher in the pasture than it was in the meadow. The calcium percentages in all cases increased with depth. The sodium closely followed the calcium trends. The correlation between sodium and calcium was highly significant for all locations. The correlation coefficients (r) were as follows: west end, 0.983; north side, 0.543; south side, 0.968; and east end, 0.980; with 0.462 required for significance at the 1% level. The per cent sodium

[4] Laws, W. Derby, The potassium Status of Eight Texas Soils, As Related to Crop Yield and Plant Composition. Accepted for publication in *Soil Science* 1962.

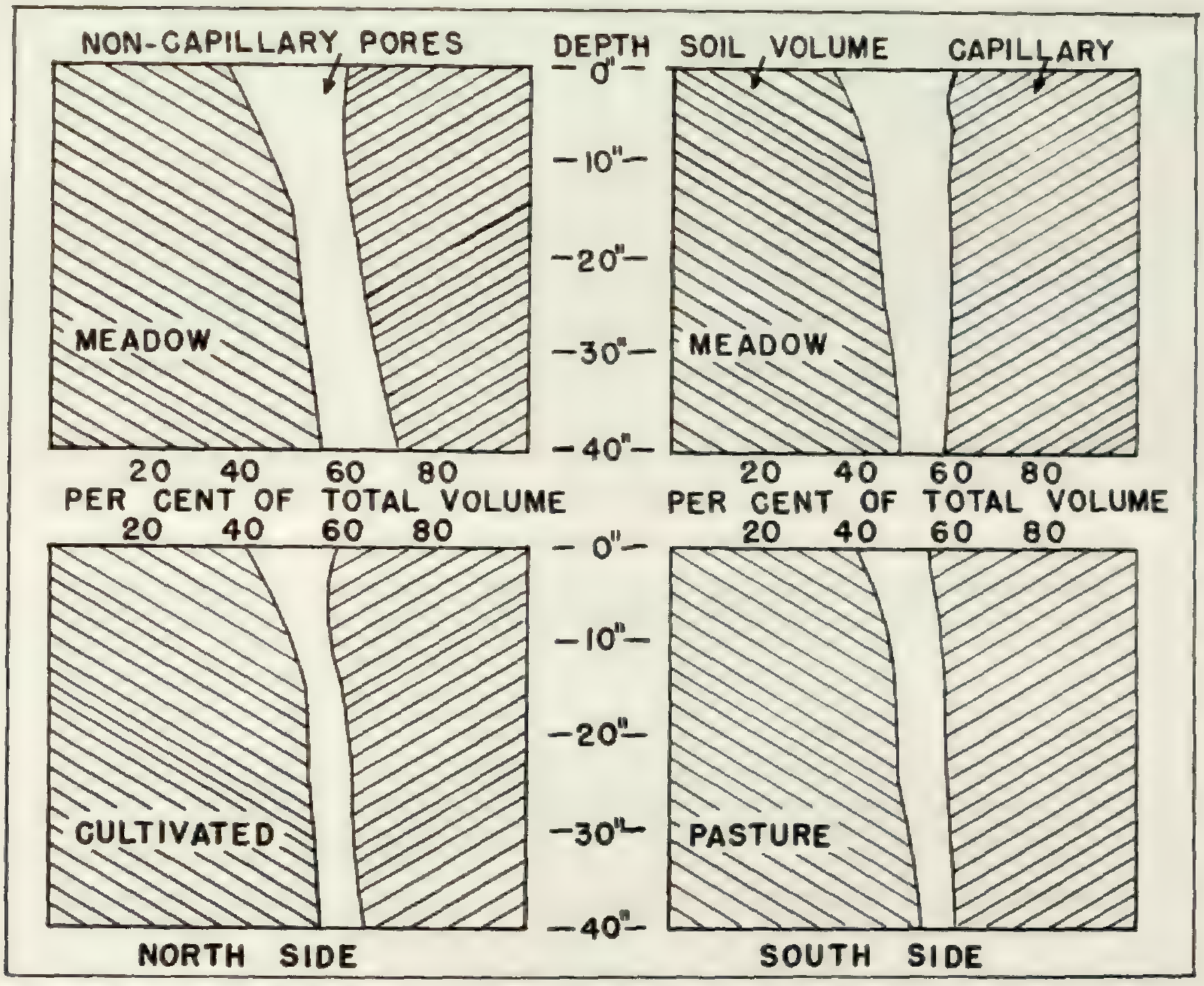

Fig. 39. Pore-space relationships of the meadow, pasture, and cultivated soils.

present was much lower than that of calcium, but it increased with depth and also was lower in the cultivated soil than in the meadow soil in all locations where the calcium was lower. This would indicate that the sodium, as determined in these soils, was probably contained in the white rock or calcium carbonate present in the soil.

Site Effect. There was a tendency for the three locations or sites, across each side of the meadow to differ in properties, so the data are summarized in Tables 29 to 32 to show averages for each site over all depths. Table 29 shows that there was no difference in bulk density of the two soils along the west end. However, the field capacity of the meadow was significantly lower than that of the cultivated soil while the non-capillary pore space was significantly higher. Although the two soils differed in these physical properties the three sites or holes dug along the west end did not.

The data in Table 29 indicate that the organic matter increased signifi-cantly from south to north in the meadow soil, but showed no definite trend in the cultivated soil. The nitrogen, phosphorus, and potassium also increased from south to north while the calcium and sodium showed no definite trends, being higher at the middle site than at either the north or south site and lower at the north site than at the south site. Along the east end (Table 30) the organic matter and nitrogen were higher at the north site than on the south site; however, the middle site was somewhat lower. Phosphorus and potassium also followed this trend, while calcium and

sodium were much higher in the middle location than at the ends. The middle site at the east end was in a drainage area or branch and the soil tended to be gravelly; however, the gravel present was calcareous stones which would account for the increase in calcium and sodium content at this site. By comparing Tables 31 and 32, it can be seen that the organic matter content, nitrogen content, and phosphorus content of the meadow soil when averaged out along the north side was higher than for the same meadow soil along the south side. This is in keeping with the observations already made that these constituents increase in content from south to north.

Table 31 shows that the organic matter, nitrogen, and phosphorus content of the soil in the meadow tended to decrease from west to east along the north side. Along the south side, the tendency was not marked since the middle site was higher in nitrogen and lower in organic matter than either the west or east sites. Along the north side where the soil was compared to cultivated soil, the meadow was significantly different from the cultivated soil on the Huffhines' farm in bulk density, field capacity, noncapillary pore space, organic matter, nitrogen, phosphorus content, and aggregation, but not significantly different in potassium, calcium, or sodium. On the south side, the meadow had a lower bulk density and a higher noncapillary pore space than the buffalo grass pasture over the fence. The pasture, however, was higher in phosphorus, calcium, potassium, and sodium content.

If the average organic matter, nitrogen, phosphorus, potassium, calcium, and sodium content of the east end is compared to that of the west end, it is found that in all cases the meadow soil on the east end was lower in these six constituents than the meadow on the west end. This is in keeping with the data in Table 31 which show that the constituents decreased from the west hole to the middle hole to the east hole. One thing which stands out in these data when they are summarized according to the site, is that the northeast corner of the virgin meadow was very low in calcium and sodium as compared with the other sample areas and it appeared that the white rock had been leached out of this particular area.

SUMMARY

The meadow was markedly different from the cultivated soil along the west and north sides in nearly all properties measured. There were very few of the properties which were different from the meadow when samples were obtained from the buffalo grass pasture along the east and south side. These two pastures have a typical buffalo-wallow topography which would lead to the conclusion that they had not been plowed but had been overgrazed to the extent that most of the native vegetation had disappeared and the buffalo grass had become dominant. If this were true, it seemed probable that the overgrazing would have a similar effect to cultivation on the properties measured. However, the only real difference was in the

bulk density along the south side of the meadow, and in the aggregate stability, which was significantly better in the native meadow.

In general, the organic matter, nitrogen, and phosphorus content of the meadow soil tended to increase from south to north and decrease from west to east. Fig. 37 shows that there was a 10-foot fall from west to east which might influence these constituents. No such slope exists from north to south.

The northeast corner of the meadow was much lower in calcium and sodium than the other areas sampled.

There was a significant positive correlation between the sodium and calcium released by a nitric-perchloric acid digestion and a significant negative correlation between the potassium and calcium released by this digestion.

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SEED OF NATIVE TEXAS GOURD, CUCURBITA TEXANA, NOW AVAILABLE TO GENETICISTS[1]

DONOVAN S. CORRELL

In 1848, Adolf Scheele (Linnaea 21: 586) described as *Tristemon texanum* a plant collected by F. J. Lindheimer along the Guadalupe River in Texas. Asa Gray subsequently correctly placed the plant in the genus *Cucurbita* (Boston Jour. Nat. Hist. 6: 193. 1850). During the next seventy-nine years this plant, apparently endemic to several watercourses in south-central Texas, received little attention. Then, in 1929, L. H. Bailey, who was studying the Cucurbitaceae, exhibited an interest in the plant and made a trip to Texas to find and collect seeds of the species. He, in company with B. C. Tharp, found plants along the Guadalupe River near Cuero, DeWitt County, from which ripe fruits were collected. Bailey grew plants at Ithaca, New York, and made further botanical observations regarding the species (Gentes Herbarum 2: 175–177, figs. 94–95. 1930).

Apparently no one has ever crossed this endemic species with the cultivated cucurbits. According to T. W. Whitaker, Geneticist, Agricultural Research Service, U. S. Horticultural Field Station, La Jolla, California, he has tried unsuccessfully for some twenty years to obtain seeds of *C. texana* for genetical studies. The writer made an extensive search for this plant along several of the rivers of south-central Texas during late summer and fall of 1962. Several colonies were located along the banks and flood-plain regions of the Guadalupe River near Cuero, probably the same area that was earlier visited by Bailey. The most extensive colony, from which fruits were collected November 11, 1962, *D. S. Correll 26838*, (Fig. 40), formed a covering over a large mass of debris and driftwood on the west bank of the river some two hundred yards north of the bridge of the highway between Cuero and Goliad. Fruits were sent to Dr. Whitaker as well as to Dr. W. P. Bemis, The University of Arizona. Additional fruits were sent to Dr. W. H. Skrdla, Coordinator, North Central Regional Plant Introduction Station, U. S. Department of Agriculture, Ames, Iowa, where they were assigned the Plant Introduction No. 285213. This collection will be maintained at Ames for future distribution to plant breeders and geneticists.

[1] The writer wishes to acknowledge that this is a part of the project on a manual of the vascular plants of Texas which is being supported by a grant (G15901) from the National Science Foundation, and which is to be prepared jointly with Dr. Marshall C. Johnston of The University of Texas.

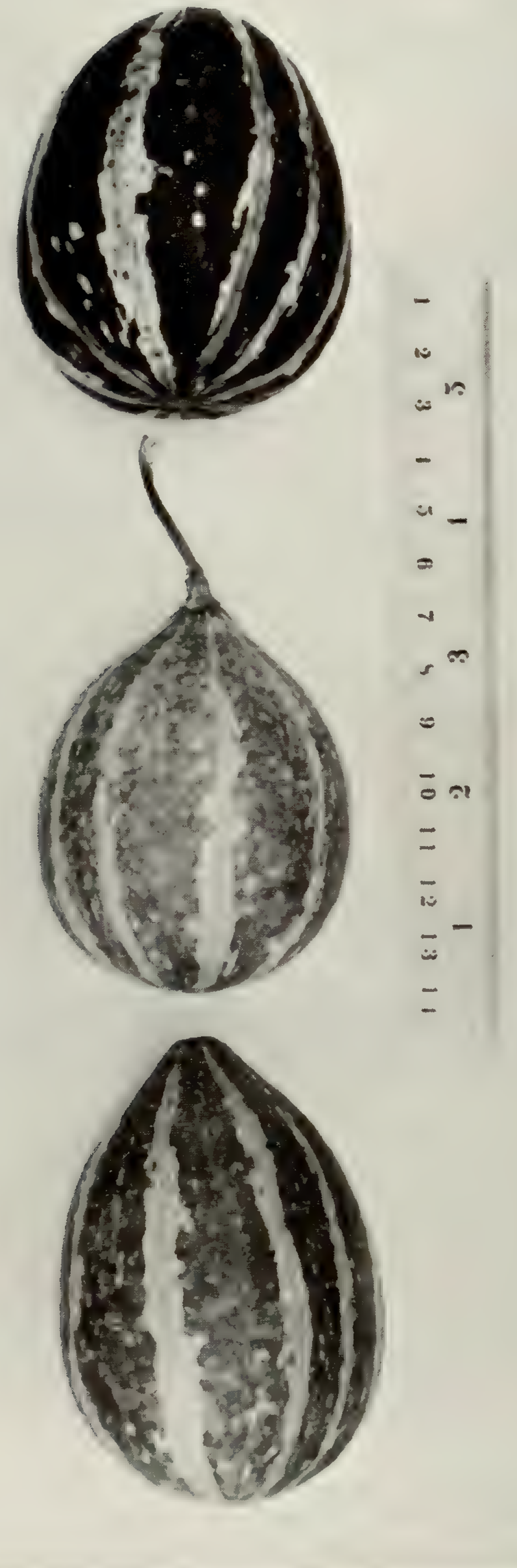

Fig. 40. *Cucurbita texana* (Scheele) A. Gray (*Correll 26838*). Several fruits collected along the Guadalupe River near Cuero, DeWitt County, Texas.

A TAXONOMIC RE-EVALUATION OF DYSSODIA TENUIFOLIA AND ALLIES (COMPOSITAE) OF THE MEXICAN HIGHLANDS

MARSHALL C. JOHNSTON[1]

Some of the features which appear to be "derived" or specialized in plants of the American tagetineous genus *Dyssodia* are: (a), fused cuplike involucre in which individual phyllaries are indistinguishable; (b), absence of the outer accessory bracts or calyculum; (c), humble stature; and (d), short lifespan. In the highlands of Mexico are found the only plants which embody all these features. They typify the Section *Hymenatherum* (Cass.) O. Hoffm., which is unique also in having a basic chromosome number of x = 8, Johnston and Turner (4). These plants as a group exhibit remarkable morphic uniformity in all characteristics except pappus form, which runs the gamut of variability, encompassing nearly all the pappus forms encountered in the entire genus *Dyssodia* in the broad sense of Hoffman (3). On the basis of some of these pappus characteristics, the last two workers to revise this group, Gray (2) and Rydberg (6), have distinguished more than one species, including especially *Dyssodia tenuifolia* (Cass.) Loes. and *D. Neaei* (DC.) Rob. Of course, synantherologists of the last century ascribed great intrinsic significance to pappus form, deeming it less mutable than for example characters of the herbage. But in each taxonomic problem, the value of each character is to be weighed anew, without presuppositions as to the relative value of characters of certain parts of the plant.

As is usually true for Mexican plants, exsiccatae are scarce. The scarcity is apparently enhanced in this group because they are humble ephemeral annuals, erratic and localized in occurrence and easily overlooked. A canvass of eight herbaria, including some of those richest in Mexican material, turned up fewer than thirty-five collections.

The pappus-variations encountered in the specimens examined can be classified conveniently into three categories, as follows:

"Tenuifolia" form. Pappus of ten or more paleae, each palea being deeply dissected into at least three awns; included here also are forms reminiscent of *D. Belenidium* (DC.) Macl. or *D. Thurberi* (Gray) Rob. in which each of the ten paleae is one-awned from a bifid apex, the two laterals being too short to be called awns; lumped here also are forms with one to several short outer muticous paleae in addition to the many polychaetous ones.

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"Pentachaeta" form. Pappus of ten paleae in two alternating series of five each, the inner five each one-awned (often from a bifid apex), the outer five muticous; this form is reminiscent of *D. pentachaeta* (DC.) Rob., *D. Hartwegii* (Gray) Rob., and *D. Treculii* (Gray) Rob.

"Gentry" form. Pappus of several paleae, all muticous and short, including also forms in which an occasional palea is one-awned.

The geography of these pappus-variations is presented in Fig. 41 in which the symbol "X" signifies the "Tenuifolia" form, the symbol "P" the "Pentachaeta" form, and the dotted circles the "Gentry" form. The assignment of the Distrito Federal as the provenance of one specimen is guesswork. This mapping, in my opinion, fails to reveal any geographic separateness of the pappus-forms which might support a treatment of these forms as allopatric species, varieties or subspecies.

Further important evidence is afforded by the frequent occurrences in the same population of two or more of the pappus-forms (note, however,

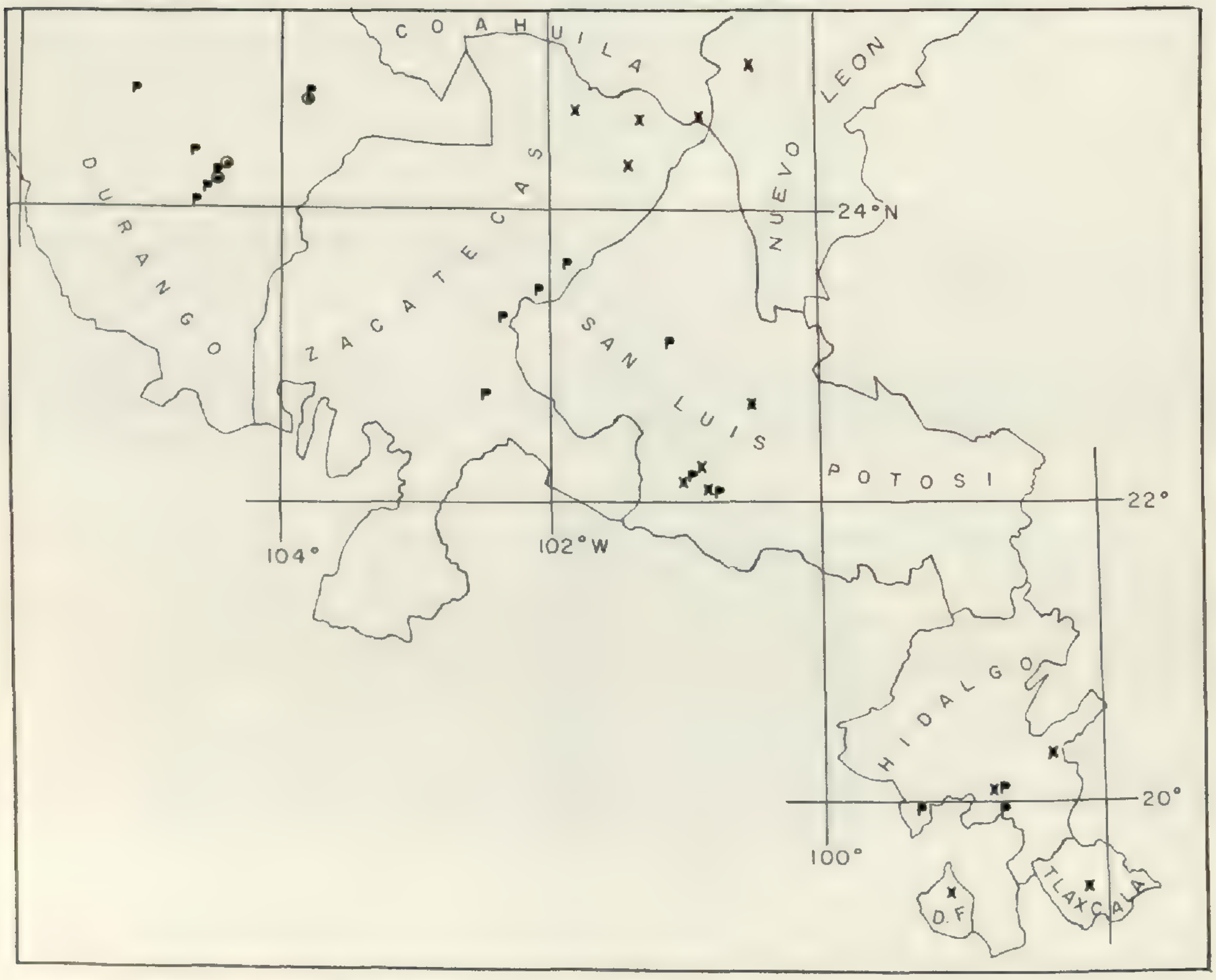

Fig. 41. Distribution of *Dyssodia tenuifolia* (Cass.) Loes., in the broad sense, as revealed by herbarium records. The symbols "O", "P", and "X" stand for the pappus form, as explained in the text.

that on any single plant all the flowers have the same pappus-form). That such occurrences exist is substantiated by the inclusion by various collectors of two or more of the pappus-forms under a single collection number and verified by my own field observations.

The tentative inclusion of all the plants in one species is warranted. It does not seem to be worthwhile to dub the pappus-forms with Latin names. The synonymy is given below.

DYSSODIA TENUIFOLIA (Cass.) Loes., Bull. Herb. Boissier, series 2, 6: 866. 1906.

Hymenatherum tenuifolium Cass. Dict. Sci. Nat. 22: 314. 1821. The type is presumably still in the Jussieu Herbarium (P); of it Gray possessed "two or three achenes and pappus." I have seen these fragments (GH). Cassini said his plant was from Chile, but Gray (2) says "Cassini's plant probably was not Chilian," and Rydberg (6) says "specimen of uncertain source." *Thymophylla tenuifolia* (Cass.) Rydb., No. Amer. Fl. 34: 173. 1915.

Hymenatherum Neaei DC., Prodr. 5: 642. 1836. The type specimen (in the Delessert Herbarium, G; photographs, F, US) carries no indication of provenance, but merely "Voy. de Nee." DeCandolle says "Chile?," but Rydberg (6) says "probably Mexico." *Dyssodia Neaei* (DC.) Rob., Proc. Amer. Acad. Arts & Sci. 49: 507. 1913. *Thymophylla Neaei* (DC.) Rydb., No. Amer. Fl. 34: 173. 1915.

Hymenatherum boeberoides Gray, Pl. Wright. 1: 115. 1852. Mexico, *Mr. Bates* (seen at GH). Gray said "this I possess from Sir William Hooker's duplicates." Gray himself (2) submerged this under *H. Neaei.*

Hymenatherum diffusum Gray, Pl. Wright. 1: 116. 1852. Mexico, *Tate* (K? Gray says "in herb. Hook," but holotype or isotype seen at GH). *Dyssodia diffusa* (Gray) Rob. Proc. Amer. Acad. Arts & Sci. 49: 507. 1913. *Thymophylla diffusa* (Gray) Rydb. No. Amer. Fl. 34: 173. 1915. Rydberg gives the distribution as "Chihuahua," but upon what basis I do not know.

The recent tentative report of the occurrence of *Dyssodia diffusa* in Durango by Gentry (1) was based on an erroneous tentative determination of the type specimen of *D. Gentryi* M. C. Johnst.

The specimens are cited by states, their institutions being indicated by abbreviations according to Lanjouw and Stafleu (5); the symbol "ZDSLP" signifies a herbarium not included by those compilers, viz. the herbarium of the Laboratorio de Botánica, Instituto de Investigación de Zonas Déserticas, Universidad Autónoma de San Luis Potosí, San Luis Potosí, San Luis Potosí. Following the herbarium symbol I give the symbol(s) "X", "P", and/or "O" corresponding to the pappus form found in the sheet cited.

MEXICO: COAHUILA, 3 miles south of La Ventura on the road from the state boundary, Sept. 13, 1938, *I. M. Johnston 7620* (GH—"X"). DISTRITO FEDERAL (?), "Val de Mexico," August 22, *Schaffner 81* (GH—"X"). DURANGO, Durango, June, 1896, *E. Palmer 280* (GH, MO, US, MEXU, MICH—all "P"); Tejamen, Aug. 21–27, 1906, *E. Palmer 540* (US—"P"); Arroyo de San Vicente de la Fábrica Maderera, 1911, *Patoni-Ochoterena 9312*, (MEXU—"P"); 12 miles south-west of Villa Madero, Aug. 24, 1939, *Shreve 9159* (GH, MICH, PH—all "O"); Yerbanis,

Sept. 25, 1943, *Gentry 6891* (GH & MICH—"P", US —"O"); 8–9 miles northeast of C. Durango near Rio Mesquital, Oct. 1, 1948, *Gentry 8571* (MEXU—mixed "P" & "O"; MICH, US, & GH—all "O"); 18 miles northeast of C. Durango, Oct. 1, 1955, *M. C. Johnston 2839* (SMU & TEX—"P"); 21 miles north of Durango, Oct. 7, 1955, *M. C. Johnston 2954* (SMU—"P"). HIDALGO, near Pachuca, Aug. 12, 1898, *Pringle 6959* (MEXU—mixed "P" & "X"; US—"X"; GH, MO, PH—all "P"); El Salto station, Sept. 16, 1903, *Pringle 11543* (GH, MO, US—all "P"; SMU—mixed "P" & "X"); near Metepec station, June 26, 1904, *Pringle 13063* (GH, MO, SMU, US—all (SKT) "X"); Telles, Sept. 21, 1910, *Orcutt 4126* (GH & MO—both "P"). NUEVO LEÓN, 2 miles east of the main Matehuala-Saltillo highway on the road to Galeana, Oct. 1, 1960, *M. C. Johnston 5864* (TEX—"X"). SAN LUIS POTOSÍ, 1878, *Parry & Palmer exs. 517* (OH, MO, PH & US—all "X"); without locality, *Schaffner s.n.* (MEXU—"X"); San Luis Potosí, 1879, *Schaffner exs. 326, 752* (PH & US—both "X"); Charcas, July—Aug. 1934, *Lundell 5473, 5547* (MICH & US—both "P"; TEX—mixed "P" & "X"); 5 kilometers west of San Lorenzo, km. 62 of the San Luis Potosí-Antiguo Morelos highway, Sept. 4, 1955, *Rzedowski 6454* (ZDSLP—"X"); near Soledad Diez Gutiérrez, July 30, 1956, *Rzedowski 7925* (ZDSLP—mixed "P" & "X"); 11 miles from San Luis Potosí on the road to Rio Verde, Sept. 21, 1959, *M. C. Johnston 4041B* (TEX—mixed "P" & "X"). TLAXCALA near Tlascala, Sept. 1876, *Schaffner 326* (GH—"X"). ZACATECAS Cedros, Aug. 1908, *F. E. Lloyd 109* (US & MO—"X"); 6 miles south of Sierra Hermosa on the road southwest to Zacatecas, Sept. 4–5, 1938, *I. M. Johnston 7415* (GH—"P"); Villa de Cos, Sept. 4–5, 1938, *I. M. Johnston 7426* (GH & US—both "P"); 20 miles south of Majoma, Sept. 4, 1938, *Shreve 8585* (US—"P"); 30 miles from Concepcion del Oro and 14 miles from San Tiburcio on the winding road between them, June 26, 1955, *M. C. Johnston 2610A* (SMU & TEX—"X"); 9 miles east of Zacatecas on the road to Aguascalientes, Oct. 2, 1955, *M. C. Johnston 2840B* (SMU—"P"); 12 kilometers northeast of Concepción del Oro, Oct. 9, 1957, *Rzedowski 9339* (ZDSLP—"X"). STATE AND LOCALITY UNDETERMINED, Sept. 1914, *C. Reiche s.n.* (MEXU—"P").

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A NEW SPECIES AND SOME NEW NOMENCLATURE IN THE TEXAS FLORA[1]

Marshall C. Johnston

Paronychia Drummondii T. & G., Fl. No. Amer. 1: 170. 1838.

This species was based on *No. 93* of Drummond's second collection, which was probably from the sandy soils of the coastal plain near San Felipe or Bastrop. An isotype has been seen (TEX). The species comprises erect, annual herbs. The main stems are 5–20 cm. long, and give rise above to ascending pseudodichotomous branches which are also 5–20 cm. long and which in turn bear the numerous, dense cymes. The leaves are pointed with a definite apical angle. The hooded sepals are broadly white-margined and bear a pronounced dorsal mucro more than 0.5 mm. long. Some representative specimens seen, all from sandy soils of the coastal plain, are cited here.

TEXAS: Anderson Co., 6 miles northwest of Tennessee Colony at Gus Engeling Wildlife Management Area, 1951, *Marsh 80* (TEX). Aransas Co., stable dunes near Aransas County airport, July 8, 1957, *Correll & I. M. Johnston 17601* (LL). Austin Co., Belleville, May 4, 1940, *Warnock 227* (TEX). Bastrop Co., 5 miles south of Elgin off Highway 95, April 18, 1945, *Lundell 13526* (LL); 2 miles east of Elgin, July 11, 1958, *Correll & I. M. Johnston 19592* (LL). Caldwell Co., without specific locality, Spring, Summer 1931, *McBryde s.n.* (TEX). Colorado Co., Altair, June 19, 1923, *Tharp 2396* (TEX). Freestone Co., about 5 miles south of Dew off U. S. Highway 75, June 16, 1944, *Lundell & Lundell 12966* (LL). Gonzales Co., Ottine, May 5, 1928, *Bogusch 3208* (TEX). Hardin Co., 4 miles west of Silsbee, May 17, 1958, *Thompson & Turner 98* (TEX). Harris Co., half mile north of San Jacinto River off Highway 59, June 10, 1958, *Traverse 774* (LL, TEX). Henderson Co., 3 miles southeast of Athens, May 19, 1947, *McVaugh 8386* (LL, TEX). Lee Co., 6 miles east of Lincoln, April 26, 1947, *Rowell & Barkley 17T107* (TEX). Leon Co., 11 miles northeast of Centerville on route No. 7, May 26, 1959, *Correll, I. M. Johnston & G. Edwin 22398* (LL). Robertson Co., Southworth Bog 15 miles east of New Baden, April 30, 1948, *Rowell 8042* (TEX). San Augustine Co., 5 miles north of San Augustine, on old Center road, May 2, 1957, *Correll 16176* (LL). Smith Co., 1.5 miles north-west of Lindale, July 24, 1953 *Tharp & Turner 3138* (TEX).

Farther to the south, in the deep fine sands of Aransas and San Patricio counties, and still farther south in the eolian plain centered in Kenedy and Brooks counties are found plants related to *P. Drummondii* but differing radically in habit and less radically in leaf shape and details of the sepals.

[1] These are some of the results of work supported by National Science Foundation Grant G15901 to Texas Research Foundation.

Paronychia Jonesii M. C. Johnston, sp. nov.

Planta *P. Drummondii* valde cognata, tenuior, autem, saepe diffusissima, etiam prostrata, folia plerumque minora habens; sepala multo minora (ca. 1 mm. longa), margine albo multo angustiore, aut mutica aut mucrone minuto saltem praedita.

Annual herbs, taproot very slender; main stem slender, erect, only 1–2 cm. long, giving way above to several, slender, prostrate, pseudodichotomous branches as much as 5 dm. long, the entire plant forming a mat, the internodes olive-brown with fine, white, retuse, somewhat viscid, spreading hairs; leaves opposite, sessile, apically rounded, basally very long-attenuate, entire, covered with fine white, antrorse somewhat viscid spreading hairs, the basal ones (present in young plants but quickly withering) 15–40 mm. long, 3–8 mm. broad, the cauline ones much smaller and progressively smaller upwards, the smallest often only ca. 5 mm. long; stipules white and hyaline, as in this genus; cymes dense and with numerous minute, bractlike leaves; flowers ca. 1.5 mm. long or a little longer; calyx strigose, the five linear-obovate lobes erect, cucullate and crested dorsally by a divergent mucro less than 0.5 mm. long, and with a narrow white, scarious margin; petals reduced to minute, setaceous, staminode-like rudiments a third the length of the calyx-lobes; stamens 5, the anthers minute and fitting into the hoods of the calyx-lobes; ovary minute; style slender, nearly equalling the sepals and apically shallowly forked; utricle minute, filled by the single, nearly spherical, reddish-brown, shiny seed.

TEXAS: Aransas Co., Rockport, April 4, 1957, *Correll & Schweinfurth 15593* (LL); July 8, 1957, *Correll & I. M. Johnston 17642* (LL). Brooks Co., several miles southeast of Falfurrias, July 10, 1957, *Correll & I. M. Johnston 17833* (LL); 6 miles south of Encino, April 9, 1944, *Lundell 12803* (LL). Kenedy Co., 10 miles north of Raymondville, May 25, 1945, *Wagner & Barkley 16T383* (TEX). Nueces Co., Flour Bluff, May 12, 1928, *B. C. Tharp 6404* (TEX). Kleberg Co., loose sand prairie east of Mortilla Camphouse, on the coast of Laguna Madre, Laureles Division of King Ranch, April 15, 1954, *M. C. Johnston 54439* (type, TEX).

The name of this new species is intended to honor Mr. Fred B. Jones, Research Collaborator with the Welder Wildlife Foundation, Sinton, Texas, who was among the first to collect and notice the distinctness of this plant.

Paronychia Jonesii is a new addition to the fairly long list of taxa endemic to the sandy soils of extreme southern Texas. Some of the other taxa are *Brazoria arenaria* Lundell, *Croton Parksii* Croizat, *Croton Coryi* Croizat, *Abronia Ameliae* Lundell, *Phlox glabriflora* (Brand) Whitehouse, *Tetragonotheca repanda* (Buckley) Small, *Monarda fruticulosa* Epling, *Euphorbia innocua* Wheeler, *Hymenopappus artemisiaefolius* var. *riograndensis* Turner, *Polanisia erosa* ssp. *breviglandulosa* Iltis, *Croptilon divaricatum* var. *hirtellum* (Shinners) Shinners, *Ratibida peduncularis* var. *picta* (A. Gray) Sharp, *Croton glandulosus* var. *pubentissimus* Croizat, *Helianthus debilis* ssp. *Runyonii* Heiser, and *Senecio Riddellii* var. *Parksii* Cory. All these,

except *Abronia Ameliae*, *Euphorbia innocua*, and *Croton Coryi* have their closest relative in plants occurring in sandy soils in south-central or eastern Texas. The hierarchic level at which their distinctness is recognized nomenclaturally (either specific or varietal) is only arbitrary.

IBERVILLEA LINDHEIMERI (Gray) Greene var. **tenuisecta** (Gray) M. C. Johnston, comb. nov.

Sicydium Lindheimeri var. *tenuisectum* Gray, Pl. Wright. 1: 75. 1852.

THE GEOGRAPHY OF THE FIVE TEXAS SPECIES OF DICHONDRA (CONVOLVULACEAE)[1]

MARSHALL C. JOHNSTON

In a recent paper[2] Dr. B. C. Tharp and I presented a revision of the North American species of *Dichondra*. This study grew out of a desire to know the correct names of the five species which occur in Texas, *D. argentea* H. & B. ex Willd., *D. brachypoda* Woot. & Standl., *D. carolinensis* Michx., *D. micrantha* Urban, and *D. recurvata* Tharp & Johnston. For reasons of

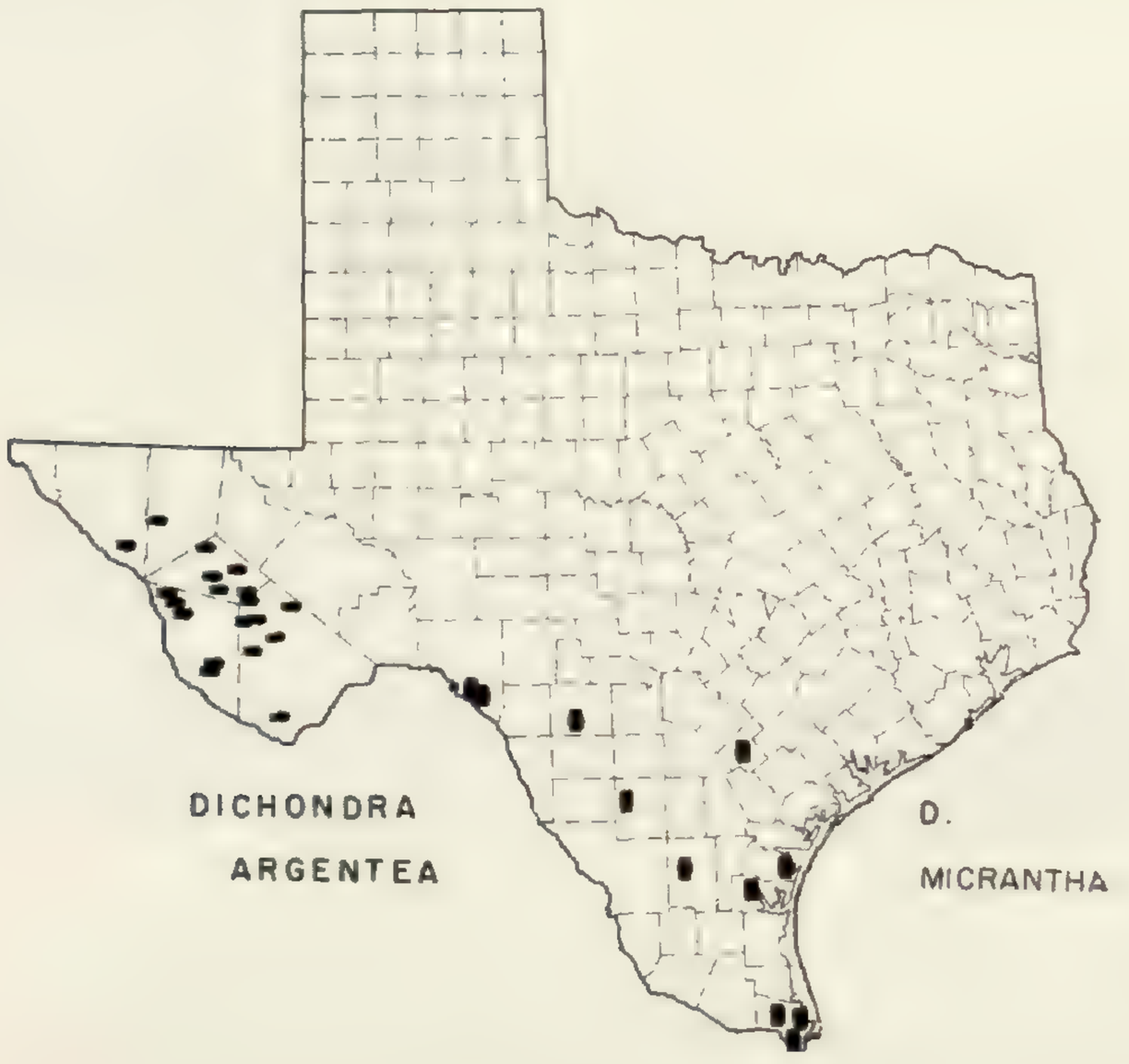

Fig. 42. Distribution of *Dichondra argentea* H. & B. and *Dichondra micrantha* Urban

economy and brevity, we were unable to present detailed information on the distribution within Texas of those five species. Since such information is interesting and valuable in studies of Texas floristics, I present it here in the form of outline maps (Figs. 42, 43, 44).

[1] The preparation of these maps was carried out in part under National Science Foundation Grant G15901 to Texas Research Foundation.

[2] Tharp, B. C. and Johnston, Marshall C. Recharacterization of *Dichondra* (Convolvulaceae) and a revision of the North American species. Brittonia 13: 346-360. 1961.

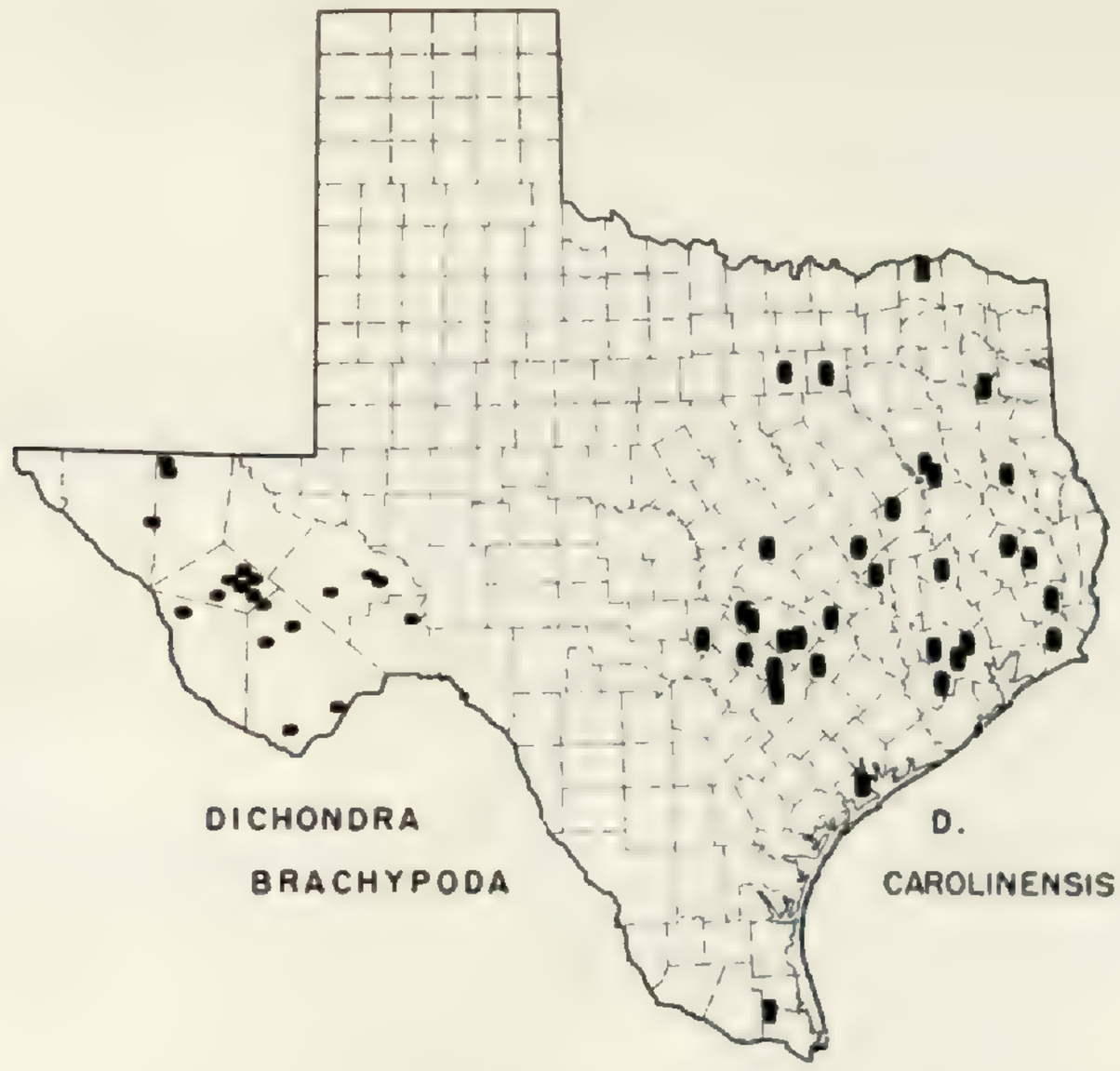

Fig. 43. Distribution of *Dichondra brachypoda* Woot. & Standl. and *Dichondra carolinensis* Michx.

Fig. 44. Distribution of *Dichondra recurvata* Tharp & Johnston.

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